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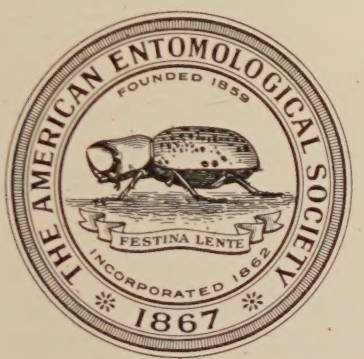

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Key to Nearctic Genera

1. Terminal joint of maxillary palpi large and strongly transverse; antennae subserrate in both sexes; anterior margin of pronotum arcuate. Elytra dilated or broader posteriorly, each with four discal costae **Calopteron** Guérin

   Terminal joint of maxillary palpi longer than wide; antennae flabellate in the male, usually subserrate in female; anterior margin of pronotum produced in a subtriangular median lobe, sinuate each side 2

2. Terminal joint of labial palpi transverse, broadly triangular; mesosternum with a narrow and entire median longitudinal impression; elytra broader posteriorly, each with four discal costae, the intervals for the most part each with a double row of cells; antennal joint 3 of male simple **Caenia** Newman

   Terminal joint of labial palpi longer than wide; mesosternum not impressed; elytra each with three or four discal costae, the intervals each with a single row of cells; antennal joint 3 of male with a short process 3

3. Elytra broader posteriorly, each with three discal costae; antennal branches of male arising apically .....**Idiopteron** Bourgeois

   Elytra subparallel or feebly broader posteriorly, each with four discal costae, these sometimes in part more or less abbreviated; antennal branches of male arising basally .....**Celetes** Newman

CALOPTERON Guérin

1830. *Calopteron* Guérin, Voy. Coquille, p. 72.
1838. *Digrapha* Newman, Ent. Mag. v, p. 380.

Form subtriangular, sides diverging posteriorly from front of pronotum to about apical fourth of elytra. Head small; when retracted, covered by pronotum to anterior margin of eyes; eyes moderate, distant; antennal prominence elevated, longitudinally impressed but not deeply divided. Antennae approximate, strongly compressed, subserrate in both sexes, more than half as long as the body; second joint very short and transverse, partly concealed in apex of first joint; third longer than wide, similar to fourth but somewhat shorter; vestiture short and nearly prostrate, moderately dense, similar in the sexes. Front short before the eyes, strongly deflexed, mouth nearly vertical; mandibles small, rather slender, abruptly bent at middle, tips somewhat recurving, briefly decussate; clypeus free, transverse, broadly and arcuately emarginate. Palpi similar in the sexes, the maxillary dilated, rapidly broader to apex, terminal joint strongly transverse, trapezoidal, feebly compressed; terminal joint of labial palpi transverse, securiform, compressed.

Pronotum small, subpentagonal, wider than long, widest at base; anterior margin arcuate, anterior angles broadly rounded, posterior angles acute and laterally prominent, base bisinuate; sides broadly reflexed, apex and base narrowly and abruptly, margins somewhat thickened; disk with an entire

and strongly elevated median longitudinal carina. Scutellum emarginate. Elytra shining, usually fasciate, broader posteriorly, each with four discal costae, intervals each with a single row of transverse or subquadrate cells, the rows sometimes more or less irregularly double toward apex.

Anterior coxae separated; prosternum moderately convex, its process between the coxae truncate at tip; anterior thoracic spiracles prominently tubulate. Abdominal sternite 8 of male broadly and arcuately emarginate at apex; sternite 8 of female entire, or with a very feeble apical sinus. Legs rather stout, strongly compressed; trochanters short, elongate triangular, the posterior pair one-fourth as long as the femora; tibiae straight, unmodified at apex, the spurs small, slender, and acute. Ventral surface of median lobe of aedeagus largely membraneous and capable of distension in a shallow sack-like formation bearing the seminal orifice, the latter covered distally by a protective cap which may be either membraneous or strongly sclerotized, according to species.

Key to Nearctic Species

1. Dorsal outline of elytra undulate in profile view, a depression before the apical black band, and another, usually less distinct, before the median band; discal costae of elytra of nearly equal elevation; black bands with a distinct bluish tinge; median band, when present, not produced along suture toward base ..... **terminale** (Say)

   Dorsal outline of elytra not undulate in profile view; first and third discal costae less strongly elevated than second and fourth; black bands not bluish; median band, when present, frequently produced along suture to base 2

2. Metasternum entirely black; second antennal joint black, following joints usually not at all paler beneath; sutural extension of median band of elytra somewhat expanding basally and widest at scutellum, forming on each side a right angle with the anterior margin of median band; median band always present, the sutural extension sometimes reduced to a small disconnected scutellar dash, rarely entirely lacking; pronotum smaller, less transverse, subtriangular; ventral surface of median lobe of aedeagus with a prominent sclerotized cap protecting the seminal orifice distally **discrepans** (Newman)

   Metasternum more or less rufous antero-medially; second antennal joint fulvous or brown, several following joints usually partly fulvous beneath; sutural extension of median band of elytra narrowing to scutellum, forming on each side a roughly obtuse angle with the anterior margin of median band; median band usually present, sometimes without a sutural extension, or lacking altogether; pronotum usually larger and more transverse; ventral surface of median lobe of aedeagus membraneous ..... **reticulatum** (Fabricius)

Calopteron reticulatum (Fabricius) (Pl. I, figs. 1 and 2.)

1775. *Lycus reticulatus* Fabricius, Systema Entomologiae, p. 203.
1838. *Digrapha typica* Newman, Ent. Mag., v, p. 380.
1847. *Digrapha affinis* Leconte, Jour. Acad. Nat. Sci. Phila., 2nd ser., I, p. 77.
?1881. *Calopteron retiferum* Leconte, Trans. Amer. Ent. Soc., IX, p. 20.

Head black; antennae black, second joint and ventral surface of several following joints more or less fulvous; pronotum fulvous with a broad median black vitta; elytra fulvous with apical two-fifths black, usually also with a slightly ante-median black band of variable extent that may be produced along suture to base. The sutural extension of the median band is parallel-sided or narrows to base, and forms on each side with the anterior margin of the band a roughly obtuse angle. Ventral surface black, metasternum more or less rufous antero-medially; base of legs and sides of abdomen sometimes fulvous. Dorsal pubescence short, decumbent or nearly prostrate, moderately dense, evenly distributed, shorter and less conspicuous on elytral fasciae; longer hairs of elytra very sparse, decumbent. Length 9.5-18 mm.

Eyes rather large in the male, separated medially above by about one and one-fourth times the length of an eye, smaller and separated by about one and two-thirds in female. Antennae similar in the sexes, subserrate, of nearly equal width throughout, two-thirds to three-fourths as long as the body; third joint longer than first, subtriangular, one-half longer than wide; fourth trapezoidal, one-half longer than third, about twice as long as wide; following joints similar to fourth, subtriangular. Clypeus transverse, with a broad and shallow arcuate emargination. Maxillary palpi short and stout, compact, rapidly wider to tip, terminal joint trapezoidal, nearly twice as wide as long on the inner side, apex oblique. Terminal joint of labial palpi securiform, wider than long, about two-thirds as wide as fourth maxillary, apex somewhat oblique.

Pronotum over one-half wider than long, subpentagonal, anterior angles broadly rounded but evident. Elytra six times as long as pronotum, conjointly at apical fourth about three-fifths as wide as long; discal costae two and four more strongly elevated than one and three and nearly entire; intervals each with a single row of cells, becoming somewhat irregular apically but not definitely dual, cells strongly transverse, two to three times as wide as long; dorsal outline of elytra not undulate in profile view. Median lobe of aedeagus membraneous beneath, without sclerotized cap over the orifice.

Distribution.—Eastern United States (No records from Maine, New Hampshire, or Vermont) westward to Minnesota (No definite locality): South Dakota (Elk Point, IX–4; Vermillion, X–1; Martin, IX–11); Nebraska (Halsey, VIII–26); Colorado (Regnier, X–1); Kansas (Effingham, VII; Baldwin, VIII–18; Franklin County); Oklahoma (Fort Sill, XI–23);

Texas (San Antonio, XI–1; Bosque County, VI–18; Paris, VI–25); and Arizona (Bolter collection only, possibly mislabelled); also Ontario (De Cew Falls, VII–4); and Mexico (Vera Cruz; Oaxaca).

The next species, and many others in the Neotropical fauna, closely resemble *reticulatum*, and it cannot be certain that the Fabrician name is correctly applied. Gorham's conception of *reticulatum*, as indicated definitely by his illustration in the Biologia,[2] has been followed in this discussion. Specimens examined from Oaxaca and Vera Cruz agree in every way with Nearctic examples of *reticulatum*, except in having the metasternum usually entirely black, and the trochanters and base of femora bright fulvous. A considerable amount of indiscriminate variability in the male genitalia is evident in this and in other species of *Calopteron*. It is not of such a nature that segregation into different types may be made, nor does it correlate in any way with differences in maculation or other variable features.

In all probability *C. retiferum* Leconte should be considered synonymous with *reticulatum*. It was described from a small female collected by Bolter and labelled "Ariz." A similar pair in the Bolter collection at the Illinois State Natural History Survey agree well with Leconte's type of *retiferum*. The aedeagus of the male is as in *reticulatum*, and only in the coarser and more quadrate interstitial cells of the elytra may the Bolter pair be distinguished from normal examples of that species. This character is itself subject to such instability that it is regarded as insufficient grounds for specific separation. No specimens of *Calopteron* from Arizona, other than Bolter's, have been seen. Considering the extensive collecting that has been done in that state, the accuracy of Bolter's labelling is questionable.

Calopteron discrepans (Newman) (Pl. I, figs. 3 and 4.)

1838. *Digrapha discrepans* Newman, Ent. Mag., v, p. 381.

Head and antennae black, the second antennal joint not paler; pronotum black with the sides usually narrowly fulvous; elytra fulvous with apical two-fifths and a slightly ante-median fascia black, the latter usually produced along suture to base. Median band always present, rarely failing to attain lateral margins, its sutural extension expanding to base and widest

[2] Biol. Cent. Amer., Coleop. III, part 2, 1880, plate I, fig. 17.

at scutellum, forming on each side a right angle with the anterior margin of the band. The sutural extension may be much reduced in width, or lacking except for a small scutellar dash, or, very rarely, absent altogether. Ventral surface entirely black, legs black or with extreme base of femora fulvous. Vestiture as in *reticulatum*. Length 9.25-14.5 mm.

Structure nearly as in *reticulatum*; pronotum usually smaller and subtriangular, the anterior angles scarcely evident; elytra less elongate and slightly broader posteriorly, the interstitial cells fewer in number and less strongly transverse. Ventral surface of median lobe of aedeagus with a prominent sclerotized cap protecting the seminal orifice distally.

Distribution (condensed), the species known from numerous localities in a number of the eastern states. NEW HAMPSHIRE: Franconia; Epping, VII–3; Hampton, VI–6 to VII–3. MASSACHUSETTS: Lenox, VI–17; Williamsburg, VI–30. CONNECTICUT: Cornwall, VI–2; Litchfield, VII–7; Lakeville, VIII–9. NEW YORK: Ithaca, V–27, VII–29; Buffalo; Crugers, VI–19. PENNSYLVANIA: Easton, V–24, VII–19; Reading, VI–3; Wyomissing, VI-27. NEW JERSEY: Lakehurst, IX–16; Atco, IX–19; Jamesburg. VIRGINIA: Petersburg, VI–1; Fredericksburg, V–31; Great Falls, V–2. KENTUCKY: Crailhope, V–13, 30. FLORIDA: Orlando, IV–14; Miami, IV–11, IX–22; Clearwater, VI. OHIO: Jackson County, VI–11; Conneaut, VII–17. INDIANA: Hessville, V–29; Turkey Run, VI–6. ILLINOIS: Cairo, VIII–7; Normal, V–31; Alto Pass, VI–5. MICHIGAN: Midland County, VI–14; Lake County, VII–12; Berrien County, VII–14. MINNESOTA: Minneapolis, V–3, VII–12. IOWA: Lee County, VI–20. MISSOURI: St. Louis, VIII–22. NEBRASKA: Halsey, VI–29. KANSAS: No definite locality. OKLAHOMA: Murray County, V–11. ONTARIO: Toronto, VI–6; Prince Edward County, VII–17; Ridgeway, VI–11.

For this species the most appropriate of the older published names has been tentatively selected, rather than add a new and probably superfluous one to the list. The species has heretofore been confused with *reticulatum*, to which it bears a deceptive resemblance. Examples of either species with fully developed color patterns may be identified at a glance by the form of the elytral fascia and its sutural extension. Specimens having the sutural extension reduced or absent are less easily placed, but the color of the second antennal joint may usually be relied upon for this purpose, although the character may be misjudged unless viewed

under sufficient magnification in a favorable light. Modifications of the *discrepans* type of male genitalia have been noted in a number of species from Mexico and Central America. They constitute a well-defined generic division that apparently is not characterized by any external structure.

Calopteron terminale (Say) (Pl. I, fig. 5.)

1823. *Lycus terminalis* Say, Jour. Acad. Nat. Sci. Phila., III, p. 178.
1838. *Digrapha divisa* Newman, Ent. Mag., V, p. 381.
1838. *Digrapha dorsalis* Newman, Ent. Mag., V, p. 381.
1843. *Charactes duplicatus* Haldeman, Proc. Acad. Nat. Sci. Phila., I, p. 303.
1847. *Digrapha apicalis* Leconte, Jour. Acad. Nat. Sci. Phila., 2nd ser., I, p. 77.

Head and antennae black, the second antennal joint not fulvous; pronotum black with the sides usually more or less fulvous; elytra fulvous with apical two-fifths, and sometimes also a slightly antemedian fascia, bluish black. The fascia, when present, may be entire or reduced to a common central spot, or, rarely, confluent with the apical band so only the basal fourth of elytra is fulvous. The fascia is not produced along suture to base. Ventral surface and legs black, base of femora and abdomen medially sometimes fulvous. Dorsal vestiture nearly as in *reticulatum*. Length 8.5-16 mm.

Structure similar to *reticulatum*; pronotum smaller, elytra narrower at base with the margins more diverging posteriorly; discal costae of nearly equal elevation; interstitial cells less transverse, larger and more or less divided irregularly into dual series toward apex; dorsal outline of elytra undulate in profile view, strongly depressed before the apical black band. Elytra conjointly at apical fourth about three-fifths as wide as long, with the lateral margins scarcely sinuate; varying to three-fourths as wide as long, with the lateral margins distinctly sinuate.

Distribution (condensed): MAINE: Princeton, VIII–9; Augusta, VIII, IX–9; Lincoln. NEW HAMPSHIRE: Durham, VIII–17; Hampton, VII–17 to IX–15. MASSACHUSETTS: Sherborn, IX–10. CONNECTICUT: Cornwall, VII–24, IX–2; Litchfield, VIII–21; New Haven, VIII–11. NEW YORK: Yonkers, VIII–28; Mosholu, VIII–25; Yaphank, IX–4. PENNSYLVANIA: Easton, VIII–5; Uniontown, VIII–31; Swarthmore, VIII–4. NEW JERSEY: Bamber, VII–25; Ramsey, VIII–20; Phillipsburg, VIII–27. WEST VIRGINIA: Charleston, VII–9. NORTH CAROLINA: Maxton, IX–17; Black Mts., IX–2; Chapel Hill, X–13. TENNESSEE: Allardt, Fentress County, VIII–18; Huntington, Carroll County, VIII–31. GEORGIA: Valdosta, VII–20. ALABAMA:

Kushla, XI–1; Greene, VIII–11. MISSISSIPPI: Natchez, X–7; Lucedale, VII–19; Ocean Springs, XII–7. FLORIDA: Gainesville, XI–1; Marianna, VIII–12; Perrine, VII–18. OHIO: Athens, VII–24; Zaleski Forest, Vinton County, IX–22; Delaware County, VIII–20. INDIANA: Wimona Lake, VIII–21. ILLINOIS: Herod, IX–9; Oregon, IX–3; Havana, VIII–31. MICHIGAN: Bay County, VIII–29; Dickinson County, VIII–29; Oakland County, VII–16. WISCONSIN: Woodruff, VIII–30; Clark County, VIII–17. MINNESOTA: Deer Lake, VIII–27; Rapidan. IOWA: Moulton, IX–3; Lee County, VI–10. MISSOURI: St. Louis, VII–29. ARKANSAS: Osceola, Mississippi County, VIII–12; Marion County, VII; Washington County. LOUISIANA: Winnfield, VI–30; Tallulah, VIII–2. OKLAHOMA: Idabel, McCurtain County, VIII–28. KANSAS: No definite locality. TEXAS: Madison County, VII–11. COLORADO: No definite locality. ONTARIO: E. Moore Lake, VIII–4; Muskoka, VII; Hastings. MANITOBA: Aweme, VIII–7.

The opposite extremes of the aggregation herein considered to be *C. terminale* may possibly represent two distinct species. This would seem to be a certainty if only the extremes were at hand; the more slender individuals having the elytral bands only faintly bluish and with the median band usually absent; and the broader ones, more southern in distribution, having the bands distinctly blue-black with the median band usually present. These extremes are apparently connected by every possible intermediate in both dilation and maculation of the elytra, so that no positive segregation of species may be made. Numerous forms of the *terminale* type occurring in the Neotropical fauna present an even more difficult and as yet unsolved taxonomic problem.

Digrapha apicalis Leconte, heretofore listed as a synonym of *C. reticulatum,* proved on examination of the type to be *C. terminale.* The other synonymy given above could not be confirmed and has been copied from the list.

Calopteron megalopteron Leconte

1861. *Calopteron megalopteron* Leconte, Proc. Acad. Nat. Sci. Phila., XIII, p. 349.

This is a species of the *terminale* group, having the elytra undulate in profile, with an entire transverse ante-median band of nearly uniform width throughout, and a broader apical band whose subtransverse anterior margin is slightly more distant from the base of the elytra in the sutural and second costal intervals. The bands are decidedly blue-black in color, the balance of the elytra pale yellowish testaceous. The lateral margins of the elytra are quite deeply sinuate and more strongly diverging distally from apical third, a formation that is not duplicated in any examples of *C. terminale*. Leconte's types, two males with blue disks indicating Oregon, are without any doubt mislabelled, as no *Calopteron* is known to have been taken in any of the Pacific Coast and adjoining states. Because of the incorrect locality and the absence of any authentic Nearctic examples, and also because of the unmistakable Neotropical habitus of the species, it is proposed to drop *C. megalopteron* from our list.

CAENIA Newman

1838. *Caenia* Newman, Ent. Mag., v, p. 381.
1906. *Caeniella* Cockerell, Ent. News, XVII, p. 242.

Form broader posteriorly, somewhat pyriform, elytra widest near apical third, lateral margins arcuate throughout. Head small; when retracted, completely covered by pronotum; eyes large in the male; antennal prominence rather feebly elevated, divided by a narrow longitudinal impression. Antennae approximate, strongly compressed, over half as long as the body, flabellate in the male, the branches arising basally and turned ninety degrees; second joint small and strongly transverse; third broadly triangular, not ramose; vestiture very short, decumbent, similar in the sexes. Front short before the eyes, strongly deflexed, mouth nearly vertical; mandibles small, rather slender, straight basally and extending beyond clypeus, abruptly bent beyond middle, the tips slender and scarcely recurving, briefly decussate; clypeus free, subquadrate, apex feebly emarginate. Maxillary palpi long and moderately stout, gradually broader apically, terminal joint elongate, feebly compressed. Labial palpi short, terminal joint transverse, compressed, securiform.

Pronotum transverse, subrectangular, widest at base, anterior margin produced in median half in a short triangular lobe, anterior angles rounded, lateral margins parallel or feebly converging to near base, thence strongly

divergent to the acute and very prominent posterior angles, base bisinuate; sides broadly reflexed, apex and base narrowly and abruptly, margins slightly thickened; disk with an entire and strongly elevated median longitudinal carina. Scutellum narrowly emarginate and impressed at apex. Elytra suboval, each with four discal costae, the second and fourth more strongly elevated; intervals each with a double row of subquadrate cells, sometimes single on sutural interval.

Anterior coxae separated; prosternum moderately convex, its process between the coxae truncate at tip, its anterior margin forming on each side a nearly right angle with the anterior margin of hypomera; anterior thoracic spiracles with a small and scarcely prominent tubulate peritreme. Mesosternum divided longitudinally by a shallow linear impression expanding slightly at each end. Abdominal sternite 8 of male not appreciably emarginate, sternite 8 of female entire. Legs rather stout, strongly compressed; trochanters slender, elongate, the posterior pair one-third as long as the femora; tibiae straight, their apices unmodified, spurs very small, slender and acute, concealed by the apical setae.

Key to Nearctic Species

Sutural interval of elytra with a double row of subquadrate cells; antennae of female ramose, the branches shorter than in the male. Color black with sides of pronotum and basal two-fifths of elytra fulvous, the elytra also with a common black scutellar spot more or less produced posteriorly ..... **dimidiata** (Fabricius)

Sutural interval of elytra with a single row of cells, except toward apex; antennae of female not ramose, inner apical angle of joints 4 to 10 acutely produced. Dimorphic, color either entirely black, or black with sides and apex of pronotum fulvous, the elytra each with a humeral fulvous spot extending narrowly along the side to middle

amplicornis Leconte

Caenia dimidiata (Fabricius) (Pl. I, fig. 6.)

1801. *Lycus dimidiatus* Fabricius, Syst. Eleuth., II, p. 111.
?1838. *Caenia scapularis* Newman, Ent. Mag., v, p. 381.

Black; sides of pronotum usually fulvous; elytra fulvous with apical three-fifths and a common subtriangular scutellar spot black, the latter sometimes narrowly connected along suture with apical black area. Dorsal vestiture very short; longer, prostrate, and somewhat denser on pronotum; minute, curved, and closely decumbent on elytra, the hairs evenly spaced by somewhat more than their own length. Length 8.5-13.5 mm.

MALE.—Eyes very large, separated medially above by about four-fifths the length of an eye. Antennae two-thirds as long as the body; third joint transverse, broadly triangular, inner apical angle acutely produced anteriorly; fourth joint twice as long as third, nearly parallel-sided, with a process arising basally that is twice as long as the segment and compressed

in a plane at right angles to it; joints 5 to 10 similar to fourth, the processes progressively longer; terminal joint simple, longer than three preceding joints combined. Terminal joint of maxillary palpi twice as long as wide, widest before middle, feebly narrowing to apex, outer side slightly sinuate apically, inner side rounded into apex, the inner apical angle obliterated. Terminal joint of labial palpi broadly scalene triangular, outer side much longer than inner, apex minutely irregular or subdenticulate. Pronotum three-fifths wider than long, elytra six times as long as pronotum, conjointly at apical third over one-half as wide as long; intervals each with a double row of subquadrate cells, cell floors smooth, subopaque; metasternum strongly gibbous.

FEMALE.—Eyes smaller, separated medially above by about twice the length of an eye; processes of antennal joints 4 to 10 much shorter, each arising from the entire inner side of the segment; terminal joint of maxillary palpi broader.

Distribution (condensed): MAINE: Millinocket, VI–25; Casco, VIII–1; Paris, VI–23. NEW HAMPSHIRE: Center Harbor, VII–15; Franconia; Mt. Washington. MASSACHUSETTS: Monterey, VIII–21. CONNECTICUT: Cornwall, VI–10; Litchfield, VII–7. NEW YORK: Ithaca, VII–12; Buffalo; Rockaway, VII–10. PENNSYLVANIA: Wind Gap, VII–10; Reading, VI–3; Angora, VIII–9. NEW JERSEY: Riverton, VIII–8; Alpine, VII–18; Anglesea, VII–7. MARYLAND: Plummer's Island, VI–3; Montgomery County, VI–18. VIRGINIA: Glencarlyn, VI–20; Great Falls, VI–10. NORTH CAROLINA: Black Mts., VI–23; Natahala, Swain County, VIII–9. TENNESSEE: La Follette, Cumberland Mt., VIII–9. MISSISSIPPI: Lucedale, III–14, VIII–8; Richton, V–13. FLORIDA: Monticello, IV–10; Walaka, Putnam County, VI–3; Allandale, Volusia County, IV–3. MICHIGAN: Marquette, VII–28; Sand Point, Huron County, VI–20; Montgomery County, VII–14. WISCONSIN: No definite locality. IOWA: Lee County, VI–20. MISSOURI: Van Buren, Ozark Mts., VII–10. ARKANSAS: Hope, VII–7; Washington County, VIII–24; Crawford County, V–14. QUEBEC: Duparquet, VI–22. MEXICO: Cordoba.

The description of *Lycus dimidiatus*, from Carolina, by Fabricius leaves no room for doubt concerning its identity with the present species. Newman described *Caenia scapularis* from "North America", and could conceivably have had a different and Neotropical species before him, as was believed by Gorham.[3] This

[3] Biol. Cent. Amer., Coleop. III, part 2, 1880, p. 18.

seems unlikely, however, inasmuch as all other American Lycidae credited to Newman, and all announced simultaneously with *C. scapularis*, are Nearctic species.

Caenia amplicornis Leconte (Pl. II, fig. 7.)

1881. *Cacnia amplicornis* Leconte, Trans. Amer. Ent. Soc., IX, p. 22.

Dimorphic, color either entirely black; or, typically, black with sides and apex of pronotum fulvous, elytra each with a humeral fulvous spot extending narrowly along the side to middle. Dorsal vestiture minute, as in *dimidiata*. Length 7-10.5 mm.

Form and structure similar to *dimidiata*, differing principally in the broad serrate antennae of the female, which are one-half as long as the body; third joint triangular, transverse; joints 4 to 10 broadly compressed, each with inner half of apical margin abruptly produced forward in a subtriangular extension that becomes progressively longer distally and in joint 10 is as long as the outer side; median joints somewhat transverse, apical joint elongate suboval. Antennae of male nearly as in *dimidiata*, not quite as long, the terminal joint and the branches of joints 4 to 10 distinctly shorter. Elytra not as broad posteriorly as in *dimidiata*; sutural interval with a single row of subquadrate cells, except briefly at apex; cell rows of other intervals usually double, sometimes single in places.

Distribution.—typical form: ARIZONA: Huachuca Mts., VII–20; same, Ramsey Canyon; Chiricahua Mts., VIII–4, VII–29; Oracle, 14 miles east, VII–27; Santa Rita Mts., VIII–16; Arivaipa, VIII–25. NEW MEXICO: Jemez Mts., VII–11 to 27; Porvenir. COLORADO: (Leconte type).

Distribution.—melanic form: ARIZONA: Bear Wallow, Santa Catalina Mts., 8000 ft., VII–12 to 17; Santa Catalina Mts., VI–30, VII; Huachuca Mts., Ramsey Canyon; Chiricahua Mts., VII–16; same, 9500 ft., VII–9; same, Rustler Park, 8–9000 ft., VII–27; same, Turkey Flat, Cochise County, VII–22; same, Deer Park, 9–9800 ft., VII–30; Weber's Cabin; Santa Rita Mts., VI–26.

IDIOPTERON Bourgeois

1905. *Idiopteron* Bourgeois, Ann. Soc. Ent. France, LXXIV, p. 120.

Form broader posteriorly, widest at about apical fourth. Head small, when retracted nearly covered by pronotum, the eyes each side largely exposed. Antennae approximate, strongly compressed, flabellate in male, the branches arising apically, subserrate in female; second joint very short and strongly transverse; vestiture short, decumbent, moderately dense, similar in the sexes. Front short before the eyes, strongly deflexed, mouth nearly verti-

cal; mandibles small, as in *Calopteron*, clypeus transverse, scarcely emarginate. Palpi similar in the sexes, slender, not broader apically, terminal joint of each nearly parallel-sided, longer than wide. Pronotum subpentagonal, wider than long, widest at base; apical margin produced in a subtriangular median lobe, sinuate each side exposing the eyes, anterior angles prominent but rounded, lateral margins re-entrant near middle, posterior angles acute, laterally prominent, base bisinuate; sides broadly reflexed, base narrowly and abruptly, apex gradually elevated, margins somewhat thickened; disk with a strongly elevated and entire median longitudinal carina; scutellum emarginate. Elytra each with three prominent discal costae, intervals each with a single row of subquadrate and transverse cells. Anterior coxae separated, tip of prosternal process truncate between coxae; anterior thoracic spiracles tubulate, feebly prominent. Abdominal sternite 8 of male with a broad and rather deep rounded emargination; sternite 8 of female without apical sinus. Legs strongly compressed, moderately stout, trochanters slender and rather long, tibiae straight, their apices unmodified, the spurs minute and concealed by the apical setae.

Idiopteron rufulum (Gorham) (Pl. II, fig. 8.)

1880. *Calopteron rufulum* (Gorham), Biol. Cent. Amer., Coleop., III, part 2, p. 13.

1881. *Calopteron tricarinatum* Leconte, Trans. Amer. Ent. Soc., IX, p. 20.

Fulvous; antennae, palpi, scutellum, ventral surface of abdomen, and legs except at base, black or piceous; pronotum narrowly along carina and sides of body beneath fuscous. Dorsal vestiture short, coarse, decumbent, not dense, sparser and nearly evenly distributed on elytra. Length 7-11 mm.

MALE.—Eyes large, separated medially above by about seven-eighths the length of an eye. Antennae flabellate, three-fifths as long as the body; third joint triangular, nearly as wide as long, its anterior margin arcuately emarginate at base of process, process arising from inner apical angle, as long as the segment and compressed in a plane at right angles to it; joints 4 to 10 similar to third, gradually narrower distally, the process of each about twice as long as the segment; terminal joint nearly as long as the two preceding combined. Terminal joint of maxillary palpus not wider than preceding joint, two-thirds longer than wide, very slightly narrowing apically, apex feebly oblique, the inner apical angle broadly rounded. Terminal joint of labial palpus similar in shape to fourth maxillary.

Pronotum one-half wider than long, its anterior margin abruptly produced in median half in a subtriangular lobe, base of lobe extending slightly posterior to pronotal margin each side. Elytra five times as long as pronotum and conjointly at apical third nearly one-half as wide as long; discal costae strongly elevated, second and third entire, the first joining second near apex; intervals each with a single row of subquadrate and transverse cells, cell floors feebly shining, minutely and smoothly subalutaceous. Metatrochanters slender, over one-third as long as the femora.

FEMALE.—Eyes smaller, separated medially above by about one and one-fifth times the length of an eye. Antennae subserrate, three-fifths as long as the body, rather broad; third joint longer than wide, slightly longer than fourth, its anterior margin extending obliquely forward, its inner margin convex, the inner apical angle acute; joints 4 to 10 similar to third, gradually narrowing distally; terminal joint as long as the two preceding combined, suboval, the tip acute.

ARIZONA: No definite locality (Leconte type). MEXICO: Cordoba; Vera Cruz.

Also recorded from Guatemala, Costa Rica, Panama, and Brazil.

The synonymy announced above results from a comparison made by Dr. P. J. Darlington between Leconte's type of *Calopteron tricarinatum* and a female specimen of *Idiopteron rufulum*, the latter, from Cordoba, Mexico, now in the collection of the California Academy of Sciences. No representatives of this species, other than Leconte's, seem to be known from north of the Mexican state of Vera Cruz, so it is possible that Leconte's specimen is incorrectly labelled.

CELETES Newman

1838. *Celetes* Newman, Ent. Mag., v, p. 381.

Form elongate, subparallel or feebly wider posteriorly. Head small; when retracted, only partly covered by pronotum, the eyes largely exposed; eyes large; antennal prominence rather feebly elevated, longitudinally divided medially. Antennae approximate, strongly compressed, about half as long as the body, flabellate in the male, the branches arising basally and turned ninety degrees; second joint very short, strongly transverse; third joint with a short process scarcely surpassing apex of joint; processes of following joints longer; vestiture short, sparse, decumbent, similar in the sexes excepting the processes of the male, these having the hairs denser, finer, and more erect. Front short before the eyes, strongly deflexed, mouth nearly vertical; mandibles small, rather slender, straight basally, extending beyond clypeus, abruptly bent beyond middle, tips recurving, briefly decussate; clypeus free, transverse, emarginate. Maxillary palpi rather slender, feebly broader to third joint, fourth not wider than third, longer than wide, feebly compressed. Terminal joint of labial palpus longer than wide, similar in shape to fourth maxillary.

Pronotum transverse, subpentagonal, widest at base; anterior margin produced in a subtriangular median lobe, sinuate each side, more or less distinctly double around the very evident but rounded anterior angles, lateral margins diverging to the subacute posterior angles, usually more strongly divergent basally, base bisinuate; sides broadly reflexed, base narrowly and

abruptly, apex gradually elevated; median longitudinal carina entire; scutellum emarginate. Elytra each with four discal costae, these sometimes in part abbreviated; intervals each with a single row of subquadrate or irregular cells.

Anterior coxae separated; prosternum moderately convex, its process between the coxae truncate at tip, its anterior margin continuous each side in line with anterior margin of hypomera; anterior thoracic spiracles prominently tubulate. Mesosternum not longitudinally impressed. Abdominal sternite 8 of male broadly and arcuately emarginate; sternite 8 of female entire. Legs rather stout, strongly compressed; tibiae straight, their apices unmodified, the spurs minute, concealed by the apical setae.

Key to Nearctic Subgenera and Species

1. Elytra not dehiscent, feebly broader posteriorly, each with four complete discal costae .....subgenus **Celestes** Newman 2
   Elytra dehiscent, subparallel, first discal costa terminating at middle of elytral length, the second costa thereafter distant from suture by the normal width of a costal interval .....**Leptoceletes** new subgenus 3
2. Black, sides and apex of pronotum and a small humeral spot fulvous, the latter limited externally by the humeral costa .....**basalis** Leconte
3. Piceous black, borders of pronotum fulvous; elytra not extending to tips of wings .....**dehiscens** new species
   Pale fulvous, elytra with a fuscous tinge; elytra extending to tips of wings .....**pallidus** new species

Celetes basalis Leconte (Pl. II, fig. 9.)

1838. *Lycus marginellus* Newman (not of Fabricius), Ent. Mag., v, p. 381.
1847. *Celetes basalis* Leconte, Jour. Acad. Nat. Sci. Phila., 2nd. ser., I, p. 76.
1847. *Celetes tabida* Leconte, Jour. Acad. Nat. Sci. Phila., 2nd. ser., I, p. 77.
1847. *Celetes mystacina* Leconte, Jour Acad. Nat. Sci. Phila., 2nd. ser., I, p. 77.

Piceous black; sides of pronotum, small subtriangular humeral spot of elytra, and usually trochanters and base of femora fulvous. Dorsal vestiture sparse and very short; a little longer, finer, and prostrate on pronotum; shorter, coarser, and decumbent on elytra, the hairs evenly spaced by about their own length, somewhat denser on the costae. Length 6.5-9 mm.

MALE.—Eyes large, separated medially above by about the length of an eye. Antennae slightly over one-half as long as the body; third joint one-half longer than wide, apex oblique, a short process arising from basal three-fourths of inner side; fourth joint twice as long as wide, the process arising basally, twice as long as the segment and compressed in a plane at right angles to it; joints 5 to 10 similar to fourth, longer and narrower, the processes longer; terminal joint simple, as long as the combined two and one-half preceding joints; processes and terminal joint usually each with several minute denticles at apex. Terminal joint of maxillary palpus nearly

twice as long as wide, not wider than third joint, widest before middle, outer side feebly sinuate apically, inner side rounded into apex, the inner apical angle obliterated. Labial palpi small, terminal joint similar in shape to fourth maxillary. Pronotum three-fifths wider than long. Elytra six times as long as pronotum, slightly broader posteriorly, widest at apical third where they are conjointly two-fifths as wide as long; discal costae 2 and 4 attaining apex, costae 1 and 3 slightly abbreviated; intervals each with a single row of subquadrate cells, cell floors feebly shining, granularly subalutaceous. Metasternum strongly gibbous.

FEMALE.—Eyes smaller, separated medially above by about one and one-half times the length of an eye. Antennae half as long as the body, serrate, joints 3 to 10 each about as wide as long, the inner apical angle acutely produced anteriorly; terminal joint elongate suboval, nearly as long as the two preceding joints combined. Maxillary palpi stouter, terminal joint one-half longer than wide.

Distribution (condensed): MAINE: Millinocket, VI–28; Mt. Katahdin, VI–25; Lincoln County, VII–8. NEW HAMPSHIRE: Durham, VI–3; Center Harbor, VII–13; Squam Lake, VII–10. MASSACHUSETTS: Monterey, VII–8; Framingham, VI–10; Sherborn, VI–18. CONNECTICUT: Litchfield, VII–10; Cornwall, VI–18; Goshen, VII–5. NEW YORK: Ithaca, VI–22; Riverhead, VI–21; Upper Saranac, VII–12. PENNSYLVANIA: Wind Gap, VII–26; Linglestown, VI–20; South Mt., Lancaster County, VII–12. NEW JERSEY: Atsion, VI–18; Lakehurst, VI–20; Atlantic City, VI–18. MARYLAND: Sparrows Point, VI–30; Beltsville, VI–14. NORTH CAROLINA: Lake Toxaway; Black Mts., VI. TENNESSEE: Gatlinburg, VI–14; Allardt, Fentress County, VI–13. MISSISSIPPI: Lucedale, IV–28; Leaksville, IV–25; Hattiesburg, IV–25. FLORIDA: Kissimmee; Enterprise, IV–8; Greenville, IV–23. OHIO: Athens, VI–28; Jackson, VI–6; Delaware County, VII–2. MICHIGAN: Ann Arbor, VII–29; Marquette, VII–28; High Island, Charlevoix County, VIII–2. INDIANA: Gary, VI–30; Mineral Sp., VII–5; Crawford County, VI–19. ILLINOIS: White Heath, VII–9; Algonquin. SOUTH DAKOTA: Hecla, VII–7. ARKANSAS: Hope, VII–2. NOVA SCOTIA: Truro, VII–7; West River, VII–24.

LEPTOCELETES new subgenus

Similar to *Celetes*, differing in its subparallel form, scarcely broader posteriorly; elytra strongly dehiscent, the first costa terminating at middle of elytral length, the second costa thereafter distant from suture by the normal

width of a costal interval; elytral vestiture very sparse, confined mostly to the costae and margins, the intervals nearly glabrous.

Type.—*Celetes dehiscens* new species.

Celetes dehiscens new species (Pl. II, figs. 10 and 11.)

Piceous black; pronotum and scutellum fulvous, the former dusky medially; mouth parts, except maxillary palpi, fulvous. Dorsal vestiture very sparse, short and decumbent, irregularly scattered on pronotum; arranged in single, or in places irregular double, series along elytral costae and margins, more numerous at base of elytra, intervals nearly glabrous. Length 5 mm.

Male.—Form elongate, scarcely wider posteriorly. Eyes moderately large, separated medially above by about one and three-fourths times the length of an eye. Antennae short, compressed, closely approximate at base, less than half as long as the body; vestiture very sparse, much inclined or decumbent, denser, finer, and more erect on rami and terminal joint; joints 3 to 10 each with a compressed internal process arising basally, the process of joint 3 very short, the process of each following joint nearly twice as long as the segment and twisted to a plane at right angles to it, widest at apex which has several irregularly spaced denticulations; terminal joint as long as the process of joint 10 and twice as wide, denticulate at apex. Mandibles small, straight basally, strongly bent beyond middle at less than a right angle, the tips rather slender; clypeus emarginate. Maxillary palpi rather slender, compact, feebly widening to third joint which is transverse, terminal joint not wider than third, nearly parallel-sided, one-half longer than wide, apex oblique, inner apical angle obliterated. Labial palpi minute, very short, parallel-sided, terminal joint longer than wide, similar to fourth maxillary, not compressed.

Pronotum subpentagonal, one-third wider than long, widest at base; anterior margin produced in a short and broadly rounded lobe, feebly sinuate each side, anterior angles evident, narrowly rounded; lateral margins very slightly diverging to basal third, thence more strongly divergent to the subacute posterior angles; base transverse, feebly bisinuate; sides broadly and base narrowly reflexed, apex gradually elevated, margins somewhat thickened. Median longitudinal carina entire, rather obtuse; surface feebly shining, alutaceous, the reticulations coarser medially. Scutellum subquadrate, slightly narrowing to apex which is shallowly emarginate; surface sculpture as in pronotum.

Elytra strongly dehiscent from near basal third, each widest at base and narrowing to apex, four times as long as pronotum and conjointly at apical third, including their separation, about one-half wider; tips of folded wings exposed by a distance equal to one-fourth the elytral length. Four discal costae distinct in basal half, second and fourth subentire, less distinct apically; first and third not extending beyond middle of elytra, the second in apical half distant from suture by the normal width of a single interval. Transverse raised lines very sparse, irregular and indistinct, forming a single

series of cells on the costal intervals. Surface feebly shining, ground sculpture somewhat as in pronotum, coarser, subalutaceous. Ventral surface feebly shining, sparsely pubescent, subalutaceous throughout; anterior coxae rather narrowly separated, tip of prosternal process truncate; anterior thoracic spiracles tubulate, not prominent; abdominal sternite 8 with a broad and shallow arcuate emargination. Legs short and stout, strongly compressed, tibiae straight, the spurs very small and concealed by the apical setae, trochanters short.

FEMALE.—Unknown.

Holotype.—Male; Chisos Mts., Texas, July 17, 1940, collected by D. J. and J. N. Knull; located in Ohio State University collection.

Celetes pallidus new species (Pl. II, fig. 12.)

MALE.—Similar to *dehiscens*, differing as follows. Pale fulvous throughout, the head, antennae, and elytra with a fuscous tinge. Eyes larger, separated medially above by about one and one-third times the length of an eye. Scutellum longer than wide, lateral margins feebly coarctate near middle, apex divided by a deep emargination into two diverging triangular points. Elytra more elongate, six times as long as pronotum, extending to tips of wings. Length 5-6 mm.

FEMALE.—Unknown.

Holotype.—Male; Chisos Mts., Texas, July 17, 1940, collected by D. J. and J. N. Knull, located in Ohio State University collection.

Paratypes.—TEXAS: Chisos Mts., VII–4 to 22, five males located in collections of California Academy of Sciences (3), University of Michigan (1), and the author (1).

This species is very close to the preceding, of which it might be mistaken for the teneral stage. The differential characters, as outlined above, are constant for the six known examples of *pallidus*. Additional specimens of *dehiscens* are required to determine whether the two species may definitely be separated on these characters. The genitalia differ decisively in the membraneous ventral structure of the median lobe, but are otherwise quite similar. The pronotal carina in some examples of *pallidus* is briefly and feebly sulcate near the middle of its length, a condition that has also been noted in *Celetes basalis*.

Explanation of Figures

The letters a, b, and c signify, respectively, dorsal, lateral, and ventral aspects.

Plate I.

Fig. 1.—*Calopteron reticulatum* (Fabricius), male genitalia. Sparrows Point, Maryland, VII-8-32, J. W. Green.
Fig. 2.—Same, elytral maculation.
Fig. 3.—*Calopteron discrepans* (Newman), male genitalia. Easton, Pa., V-31-35, J. W. Green.
Fig. 4.—Same, elytral maculation.
Fig. 5.—*Calopteron terminale* (Say), male genitalia. Easton, Pa., VIII-6-42, J. W. Green.
Fig. 6.—*Caenia dimidiata* (Fabricius), male genitalia. Easton, Pa., VI-19-29, J. W. Green.

Plate II.

Fig. 7.—*Caenia amplicornis* Leconte, male genitalia. Bear Wallow, Santa Catalina Mts., Arizona, VII-12-16.
Fig. 8.—*Idiopteron rufulum* (Gorham), male genitalia. Cordoba, Mexico, Dr. A. Fenyes.
Fig. 9.—*Celetes basalis* Leconte, male genitalia. Litchfield, Connecticut, VII-6-25, C. A. Frost.
Fig. 10.—*Celetes dehiscens* new species. Chisos Mts., Texas, VII-7-46, D. J. and J. N. Knull.
Fig. 11.—Same, male genitalia.
Fig. 12.—*Celetes pallidus* new species, male genitalia. Chisos Mts., Texas, Big Bend Nat. Park, VII-3-40, Van Dyke collection.

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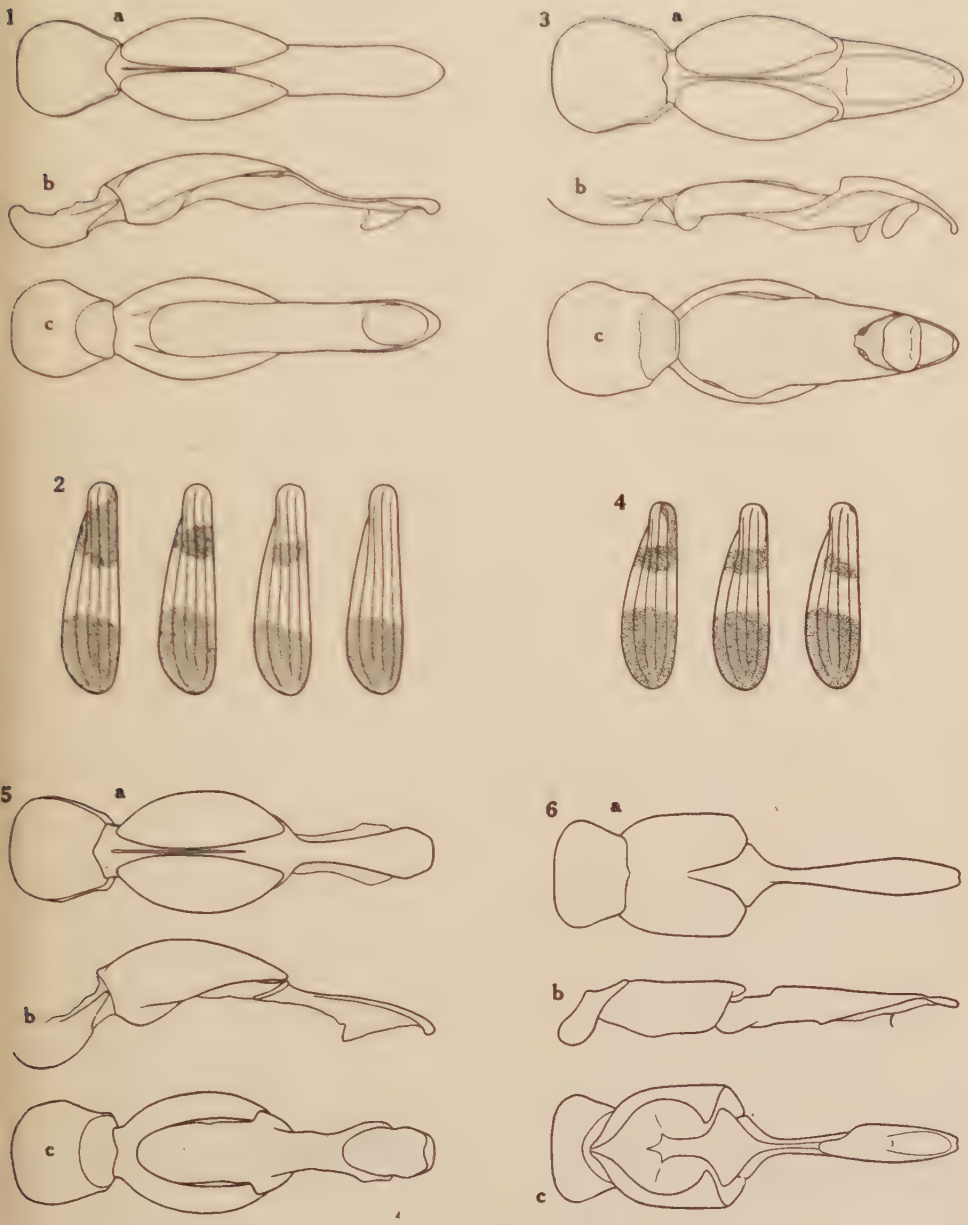
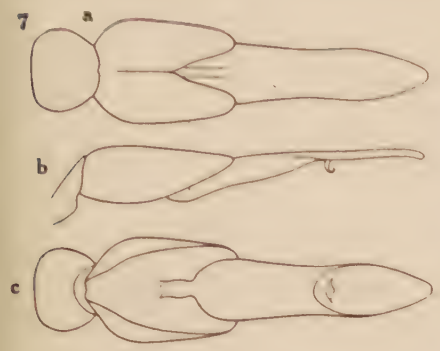
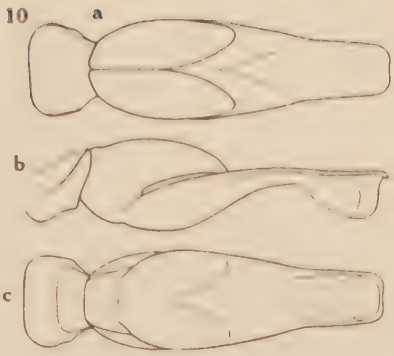
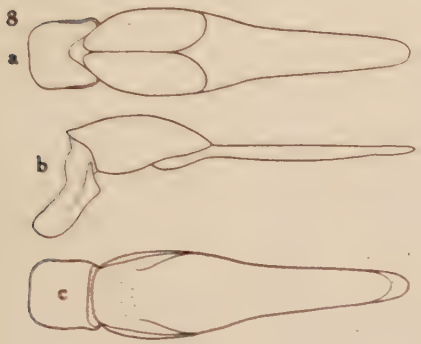
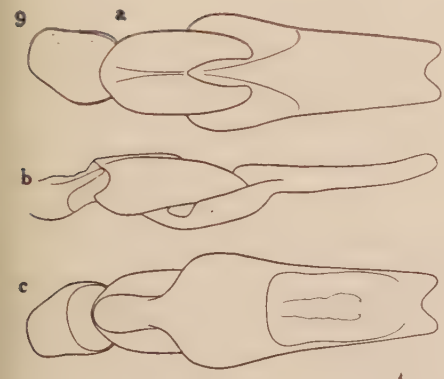


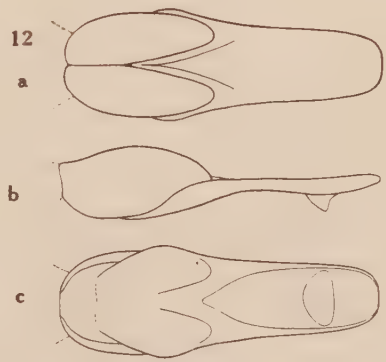
GREEN—LYCIDAE OF UNITED STATES AND CANADA











GREEN—LYCIDAE OF UNITED STATES AND CANADA

THE EXTERNAL ANATOMY OF PALAEOPLATYURA JOHNSONI JOH.

(DIPTERA - MYCETOPHILIDAE)

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The genus *Palaeoplatyura* was designated in 1899 by Meunier for *Mycetobia macroneura* described by Loew from the Baltic amber. Since that time five additional species have been described. Of these three are fossil species, the others being represented by living specimens.

Johannsen, 1909, placed this genus in the subfamily Mycetobiinae. Edwards, 1925, considered the affinities of this group to be more closely related to the Ceroplatinae. Fisher, 1941, followed Edwards' interpretation of the position of this genus. The author, 1948, has indicated that on the basis of thoracic sclerites, *Palaeoplatyura* is most closely related to the Ceroplatinae.

The reasons for selecting this particular form for study include the following:

1. It is a primitive type of a fungus gnat. From the standpoint of venation, *Palaeoplaytura* is as primitive as any other genus of mycetophilids. From the standpoint of male genitalia, it is likewise a generalized type. However, from the study of thoracic structures, the genus *Bolitophila* would seem more primitive.

2. At present, the classification of the Ceroplatinae is extremely involved. Edwards, 1929, has divided the genus *Platyura* into many subgenera. His classification of this subfamily appears to be unnecessarily complex. It is hoped that this study may stimulate other investigators of the group in order to obtain a less complicated classification.

* The author wishes to express his appreciation to Elmer Smith who prepared the drawings, to his wife M. M. Shaw, who assisted in the preparation of the paper, and to the University of Massachusetts for a research grant which covered in part the expenses.

3. No member of this subfamily has received an anatomical investigation of the entire insect. Wings, mouthparts, thoracies and hypopygia of various species have been studied but no complete investigation has been made.

Palaeoplatyura johnsoni Joh. was described in 1909 from one specimen taken in Burlington, Vermont. Since that time it has been found throughout the New England states, New York, Maryland and the Great Smoky Mountains in North Carolina. The author has found the species fairly abundant along the Eck Trail in Colrain, Massachusetts during the latter part of June.

The species is fairly large, for a fungus gnat, being 5 mm. in length. The wings are spotted. The abdomen is elongated and slender. The life cycle of this insect is not known, nor at present are the immature stages recognized.

Morphology

The Head.

The head, figs. 2-4, is wider than long, being elongate oval when viewed from the front. The compound eyes are large and make up about two-thirds of the head proper. The facets of the eye appear to be uniform in size. Between the facets are small erect setae.

The ocelli, *o,* are three in number. They are approximately uniform in size. The two lateral ocelli are located on slightly raised portions on the vertex. The ocelli are arranged in a straight line and are remote from the margin of the compound eye.

The antennae, *ant,* fig. 1, are 16-segmented. This number according to Felt, 1921, is normal for the generalized Nematocera. The basal segment or scape, *s,* is slightly enlarged distally. The second segment or pedicel, *p,* is shortened and more nearly annular than the other segments. The remainder of the antenna (14 segments) is commonly referred to as the flagellum. Crampton, 1942, has referred to the first segment of the flagellum as the postpedicel, *pp.* Since in higher Diptera, the remainder of the flagellum is greatly modified, his conception is probably correct. The remainder of the antenna is composed of 13 bead-like segments which gradually taper to the terminal segment. All of the segments of the antennae are covered with fine setae.

The sclerites of the head capsule are not as easily recognized as they are in some other insects. The vertex, *vx*, can be distinguished as the area lying between the compound eyes dorsally. Anterior to the ocelli there is a raised portion and it is probable that the postfrons, *pof*, extends ventrally from this region. The prefrons; *prf*, is reduced dorsally but expands ventrally and merges with the clypeus, *cl*, which is developed anteriorly to form a nasiform structure. The lower surface of the clypeus is covered with stout setae. The labrum, *lr*, is largely membranous, however there is a median more highly scleritized portion.

The maxillary region appears to be composed of a 4-segmented palpus, *mp*, and a reduced galea, *ga* (most evident from the caudal view). The remainder of the segments of the maxillae are not easily distinguishable.

The labium, *lb*, is composed of what appears to be basi, *bla*, and disti-labellae, *dbl*, and a median labellar process, *lp*. The prementum and mentum are highly membranous.

Posteriorly the following head sclerites can be distinguished. The occiput, *oc*, is a narrow structure which extends ventrally to merge with the postgenae, *pg*. Definite paragenal, *pag*, sclerites can be distinguished also. A gular pit, *gp*, is present at the junction of the paragenal sclerite and the postgena. Extending posteriorly from the region of the postgena is a process which seems to articulate with the lateral cervicale, *ls*, of "neck" sclerite. This sclerite is usually considered as a modified anterior portion of the prothorax.

The Thorax.

The thorax, figs. 5-7, is composed of three segments of which the mesothorax, or pterothorax is most developed with the prothoracic and metathoracic segments reduced.

Prothorax

The following sclerites of the prothorax can be distinguished.

Pronotum. The pronotum can be divided into two regions, an anterior portion, *apn*, which is scleritized and bears distinct setae and a posterior portion, *ppn*, which lies anterior to the mesothoracic spiracle, *sp*, and is not as distinctly scleritized.

Propleuron. The pleuron of the prothorax is reduced but it is possible to recognize an episternum, *es,* which is closely united with the anterior pronotum, and an epimeron, *em.* A pleural suture can be recognized extending dorso-caudally from the point of attachment of the coxa.

While the episternum is closely fused with the anterior pronotum, its approximate area can be shown by the presence of a groove which is most distinct at the anterior portion but is indistinct in the posterior region of the combined sclerites.

The epimeron is a distinct sclerite, subtriangular in shape and extends between the prothoracic and mesothoracic episterna.

A coxifer, fig. 7, *cf,* which forms the dorsal pivot for the coxa is present as a process apparently arising from the region of the epimeron. However, Crampton, 1942, states that the coxifer is developed from parts of the episternum and epimeron adjacent to the pleural suture.

Prosternum. The homologies of the sternal sclerites are difficult to determine. Crampton, 1942, states that in most lower Diptera the presternum is lacking and that the spinasternum is not a distinct area in typical Diptera.

From a comparison with other forms it would seem that in *Palaeoplatyura* a basisternum and a furcasternum were the only clearly recognizable regions. The basisternum is united with the episternum by a membrane. No scleritized precoxal bridge is present. The basisternum, *bs,* has a ventral process in which the coxa is received. The furcasternum, fc_1, is quite large and the furcal pits, *fp,* are easily observed.

Mesothorax

Notum. The notum, figs. 5-6, can be divided into four areas. Of these, the prescutum, *psc,* (figs. 5, 6), is not clearly demarked from the scutum but its position is indicated by lateral grooves extending posteriorly from the region approximately above the first thoracic spiracle, *sp.* Posterior to the spiracle is a small area, *pat,* or paratergite. The scutum, *sc,* comprises the principal region of the mesonotum. Posterior to it is the subtriangular scutellum, *sl.* Ventral to and extending behind the scutellum is the post-scutellum, *psc,* the so-called metanotum. This region is comprised of

three portions, two lateral lobes, the pleurotergites, *ptg*, and the median lobe, or mediotergite, *mt*. The term metanotum should not be used in connection with this region which has been demonstrated by Crampton and others to be mesothoracic in origin.

Pleuron. The mesopleuron, fig. 5, is readily recognized consisting of an episternite and an epimeron. The episternite is further subdivided into an upper region, anepisternite and a lower, katepisternite, *kes*. The anepisternite is divided by a dorso-ventral cleft into an anterior and a posterior region, *aae*, and *pae*.

Closely associated with the posterior division are two scleritized plates, *ba*, basalar sclerites, associated with the wing. The epimeron, em_2 is not divided. It is separated from the episternite by the pleural suture, *ps*. At the dorsal portion of the pleural suture there is a process, *dpp*, which functions as a point of articulation for the wing. Posteriorly the epimeron is bounded by the pleurotergite, *plt*.

Mesosternum. The interpretation of the sclerites of the mesosternum is a subject upon which there seems to be little agreement. Thus Snodgrass states, "In the pterothorax of higher Diptera the more primitive sutures of the sternal as well as the pleural areas have become almost obliterated and secondary grooves appear which divide the skeletal surface into parts that have little relationship to those in the more generalized orders. The large ventral plate in *Calliphora* is evidently composed of the sternum, the precoxal bridge parts of the episterna."

Concerning this view, Rees and Ferris, 1939, state, "We hold that except for the sternum of the prothorax there is absolutely no sternal element visible externally on the thorax of any Dipteron that we have seen. We hold that in the Diptera as in the Mecoptera the apparent sternal elements of the pterothorax are simply the ventral portions of the original subcoxal segment of the leg which forms especially on the mesothorax a complete or practically complete ring about the base of the coxa."

Crampton, 1942, in discussing the mesosternum in Diptera states that this region is relatively small and unimportant in most Diptera. He indicates that in *Gnophomyia tristissima* (Tipulidae) a presternum, a basisternum and a furcasternum are present. He continues, "The basisternal region may be external or it may be-

come inrolled along the median ventral line to form an internal median partition in front of the furca or paired apophysis of the sternal region. In such cases, the lower part of the episternum extends downward toward the mid-ventral region of the mesothorax."

Crampton considers that the furcasternum does not participate in the inrolling process but frequently become folded between the coxae as they approach one another in the mid-ventral region. A wing-like lateral expansion (one on either side) is frequently given off by the furcasternal region and extends along the mesal surface of the middle coxa to furnish a ventral pivotal point for the coxae when the latter are mobile.

I believe that in *Palaeoplatyura* the region, BS_2, represents the basisternum which has not been overgrown by the ventral growth of the episterna. The furcasternum, FC_2, is represented by a narrow, scleritized median band bearing internal pits for muscle attachment. Crampton, as previously stated, indicates that lateral wings may be given off from the furcasternal region extending along the mesal surface of the middle coxa. If a specimen of *Palaeoplatyura* is boiled in caustic potash and the legs removed it will be noted that there are a pair of median scleritized projections, *stp,* in both the meso- and meta-thorax. These arise from the region of the furcasterna. It was considered that these represented the " wings " of the furcasternum noted by Crampton. If a recently killed specimen is dissected, these scleritized projections seem to form the inner surface of the coxae. Whether they are portions of the furcasterna which have more or less fused with the coxae or are merely more heavily scleritized inner faces of the coxae has not been determined. It is obvious that such projections would serve to strengthen the legs particularly where the coxae are so elongate.

Metathorax

The metathorax, fig. 5, of *Palaeoplatyura* as in other Diptera is greatly reduced.

Notum. The metanotum, *mn,* is reduced to a narrow transverse band extending behind the post-scutellum. The median portion is the most heavily scleritized and the lateral extremities are somewhat membranous.

Pleuron. The metapleuron while much reduced consists of two sclerites, an episternite, es_3, and an epimeron, em_3. The pleural suture extends from the coxal process, or coxifer, to the base of the halter, *h*. The metathoracic spiracle, *sp*, appears in the membrane above the episternum and anterior to the halter.

Sternum. The sternum, fig. 7, in *Palaeoplatyura*, appears to consist largely of the furcasternum, fc_3. There is a bridge extending from the episternum to the sternal region and from the epimeron to the posterior region of the furcasternum. Whether the precoxal bridge is comprised of (1) basisternum, (2) post coxalia of mesothorax and precoxalia of metathorax or (3) represents a ventral extension from the episternum is a matter open to discussion.

Thoracic appendages

Legs. The legs, fig. 9, of *Palaeoplatyura johnsoni* are elongate and setose. As in most Mycetophilidae, the coxae are elongate—a characteristic of the family.

The coxae, *cx*, articulates dorsally with the coxifer, or process extending ventrally from the pleural suture. The coxifer is most evident in the prothoracic region, is not clearly distinct in the mesothorax but is reasonably apparent in the metathorax.

All the coxae are more or less cylindrical. They bear setae but these, as yet, have not been used as a means of classification. There is no distinct evidence of the division of the mesothoracic coxa into a eucoxa and a meron.

The trochanter, *tr*, in all legs is small, articulates freely with the coxa but is solidly attached to the femur.

The femur, *f*, is elongate and with the exception of the coxa the most robust segment of the leg. The femora are heavily clothed with setae and hairs.

The tibiae, *ti*, are the longest segments of the legs. They are covered with setulae which often cause them to appear black. In addition, there are numerous setae and at their apices spurs, *tis*. *Palaeoplatyura* possesses single spurs on the prothoracic tibiae but paired spurs on the meso and metathoracic tibiae.

The tarsi are five-segmented. The first tarsal segment, the basitarsus, *ts*, is subequal in length to the combined second and third

tarsal segments. The fourth and fifth segments become progressively shorter. The tarsal claws, *tscl*, are toothed. The empodium is prominent and bears clavate hairs. The pulvilli, or lateral pads, are lacking.

Wings. The wings, fig. 8, of *Palaeoplatyura johnsoni* are relatively long and broad and are subequal to the abdomen in length. There is a distinct anal lobe, *alo*, and the wing is patterned with two dark bands.

The venation of this fly is more primitive than it is in any of the other Mycetophilids. The costa, *C*, is strong and extends beyond the tip of R_5. Three crossveins are present, the humeral, *hm*, radio-medial, *r-m*, and medio-cubital, *m-cu*. Subcosta, *Sc*, is two-branched with the first ending in the costa beyond the origin of Rs. Radius is three-branched. The interpretation of the radial field is somewhat in dispute. According to the Comstock-Needham system the three branches would be R_1, R_{2+3} and R_{4+5}. However, Alexander, 1928, brought forth evidence to indicate that in the Diptera more specialized than the Tipuloidea, the upper branch of Radius is R_{1+2}, the second branch would then be R_3 and the third branch R_{4+5}.

Edwards, 1925, interpreted the radial field in the Mycetophilidae to consist, in the primitive groups, of R_1, R_4, and R_5. He believed that the element R_{2+3} had been lost in the Mycetophilidae, the Bibionidae and the Cecidomyiidae. Friend, 1942, on the basis of his interpretation of the venation of *Catocha* (Cecidomyiidae) would seem to follow Edwards' interpretation of the radial field.

As stated earlier, the r-m crossvein is maintained but is reduced. In related forms, i.e. *Platyura* et al., this crossvein has been lost and Rs and the upper branch of media fused for a short distance.

The interpretation of the medial-cubital fields is likewise somewhat open to dispute. According to the Comstock-Needham system, in *Palaeoplatyura*, media would be two-branched and would consist of M_{1+2} and M_{3+4}. Tillyard advanced the theory that the vein called Cu_1 by Dipterists was in reality M_4. Accordingly Cu_2 of Comstock would become Cu_1 and Cu_2 would be represented by the fold extending behind Cu_1 of Tillyard. Concerning this interpretation, Edwards, 1925, states: "The evidence on this matter, however, seems to me inconclusive, and I have therefore kept to the terms Cu_1 and Cu_2 as generally in use."

Friend, 1942, has accepted Tillyard's modification of the medial-cubital field in the Diptera. In order to be in agreement with the most recent comprehensive treatise on flies, I have decided to follow Friend's interpretation with Alexander's modification of the radial field.

The anal field is represented by only one vein.

Four axillary sclerites have been noted at the base of the wing but their homologies have not been determined.

ABDOMEN.

The abdomen, figs. 10-12, is elongated and subcylindrical in shape. It is composed of ten segments. Of these, the first eight are more or less similar in shape but becoming progressively shorter posteriorly. A ninth segment bears the external genitalia, and the tenth, or anal segment, is the final one.

Each of the first eight segments is composed of a tergite and a sternite connected by a membrane. In the anterior portion of the membrane of the first seven segments is located a pair of spiracles.

The ninth segment is comprised of a distinct tergite, fig. 12, but the sternite, fig. 11, has fused with the basistyle and no indication of the exact limits of the sternite can be noted.

The morphology of the terminalia of the males of North American Mycetophilidae has been monographed by Fisher, 1937. According to this investigator, the gonopore, *ae*, is located in the membrane between the ninth and tenth segments on a phallic papilla arising from the floor of the genital chamber. Fisher states further, " The aedeagus is very variable throughout the family but because of its minute size and the distinctive characteristics of the surrounding ninth segment, it is of little importance in specific distinctions."

The external genitalia, figs. 11-12, of *Palaeoplatyura* is relatively simple in nature. It is composed of two basi-styles, *bst*, or coxites, which are fused ventrally with the ninth sternite but separate dorsally; and two disti-styles, *dst*, which are bifurcate.

The tenth segment is represented by two supra-anal lobes, *sal*, and a sub-anal lobe which is more or less distinctly divided. The anus is located in a membranous ring within these lobes.

Abbreviations

a	— anal vein
aae	— anterior anepisternite
ae	— aedeagus
af	— antennifer
alo	— anal lobe
ant	— antenna
ao	— anal opening
apn	— anterior pronotum
ba	— basalar sclerites
bla	— basilabella
bst	— basisternum
c	— costa (wing)
ce	— compound eye
cf	— coxifer
cl	— clypeus
cu	— cubitus
cx	— coxa
dla	— distilabella
dpp	— dorsal pleural process
dst	— dististyle
em	— epimeron
es	— episternum
f	— femur
fc	— furcasternum
fp	— furcal pit
g	— galea
gp	— gular pit
h	— halter
hm	— humeral crossvein
kes	— katepisternum
la	— labella
lb	— labium
lc	— lateral cervicale
lp	— labellar process
lr	— labrum
m	— media
m-cu	— medio-cubital crossvein
mn	— metathoracic notum
mp	— maxillary palpus
mt	— mediotergite
o	— ocellus
oc	— occiput
p	— pedicel of antenna
pae	— posterior anepisternite
pag	— paragular sclerite
pas	— parascutellum
pat	— paratergite
pg	— postgena
plt	— pleurotergite
pof	— postfrons
pp	— post pedicel of antenna
ppn	— posterior pronotum
prf	— prefrons
ps	— pleural suture
psc	— prescutum
psl	— postscutellum
pss	— prescutal suture
ptg	— pleurotergite
r	— radius (of wing)
r-m	— radio-medial crossvein
s	— scape of antenna
sa	— sub-alare
sal	— supra-anal lobe
sc	— subcosta (of wing)
sc	— scutum
sl	— scutellum
sp	— spiracle
st	— sternite
stp	— sternal process
ti	— tibia
tis	— tibial spur
tr	— trochanter
ts	— tarsus
tscl	— tarsal claw
vx	— vertex

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Pages 21–31 Issued April 25, 1952 1190.30

FIG. 1 ANTENNA

FIG. 2 FRONTAL VIEW OF HEAD

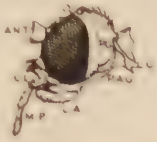

FIG. 3 LATERAL VIEW OF HEAD

FIG. 4 CAUDAL VIEW OF HEAD

FIG. 6 DORSAL VIEW OF THORAX

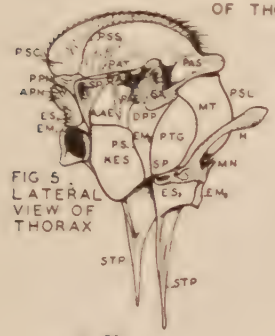

FIG. 5 LATERAL VIEW OF THORAX

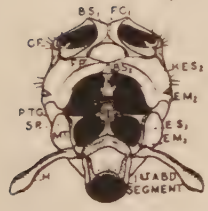

FIG. 7 VENTRAL VIEW OF THORAX

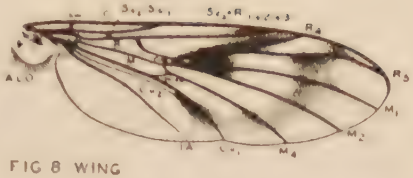

FIG. 8 WING

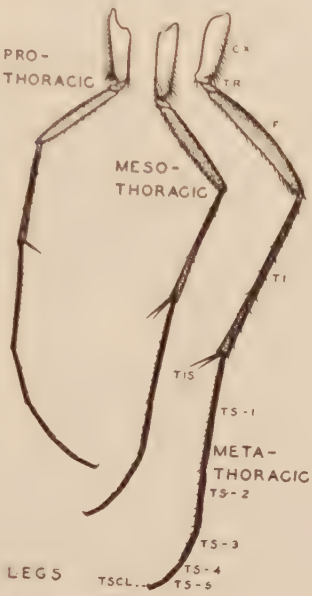

FIG. 9 LEGS

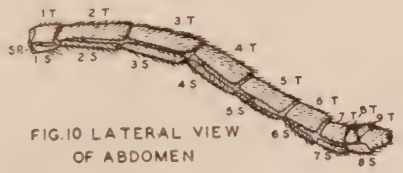

FIG. 10 LATERAL VIEW OF ABDOMEN

FIG. 11 TERMINAL PORTION OF ABDOMEN VENTRAL VIEW

FIG. 12 TERMINAL PORTION OF ABDOMEN DORSAL VIEW

EXTERNAL MORPHOLOGY OF PALAEOPLATYURA JOHNSONI

NOTES ON BLUEBERRY LEPIDOPTERA IN NEW JERSEY *

BY EMLEN P. DARLINGTON

New Lisbon, New Jersey

Historical Background

On March the first 1914 a contract was signed between Joseph J. White, Incorporated of New Lisbon, New Jersey and the United States Department of Agriculture which started the first commercial planting of the hybridized blueberry. This was accomplished largely through the cooperation of Elizabeth C. White, daughter of Joseph J. White, and Doctor Frederick V. Coville, Chief Botanist, Bureau of Plant Industry, U. S. Department of Agriculture.[1]

From this beginning the cultivated blueberry industry has grown to one of economic importance and become widespread, the chief cultural areas now being, New Jersey, North Carolina, Michigan, Washington and Massachusetts.

In New Jersey the names "huckleberry" and "blueberry" are generally used indiscriminately, but Gray used the name huckleberry for the genus *Gaylussacia* and the word blueberry for the commercially important genus *Vaccinium*.

* The present manuscript is posthumously published. It was long known to members of the Publication Committee of the American Entomological Society that the present paper was in preparation. Continued illness prevented Dr. Darlington from presenting this study before his death, and the manuscript later passed into our hands. It has been suggested that, owing to the fact that the term huckleberry is broadly used in the vernacular in most of southern New Jersey for members of both *Gaylussacia* and *Vaccinium*, the host records of entomologists not trained botanically are difficult to interpret and that "blueberry" or "huckleberry" in past literature may refer to either *Gaylussacia* or *Vaccinium*, but that since "huckleberry" is so generally used in New Jersey for the "highbush blueberry" of Gray's Manual, the New Jersey records in the literature as "huckleberry" would surely include the true blueberry records. Members of the Society's Publication Committee feel that it was very wise for Dr. Darlington to have simply taken the records as he found them and not tried to translate the common names given by Smith, 1909, for example, into scientific names. (J. A. G. R.)

[1] Coville, U. S. Dept. Agr., Bull. 334, 1916.

Having a broad distribution throughout the northern hemisphere, the blueberry is tolerant of a wide range of soil and climatic conditions but is most abundant in the acid soil regions of the north. Maine has the largest producing area in the United States, the berries coming from low-bush varieties that grow wild on the "cut over" or partially cleared lands, often called the "Blueberry Barrens"; they are gathered by scoops, screened and sold principally to the canneries. No tillage or pruning is attempted, but to keep the lands in good production they are burnt over about every third year to obtain a maximum growth of new canes.[2] Nova Scotia is also a heavy producer of low-bush blueberries.

C. R. Phipps [3] has made a comprehensive study of the blueberry insects of Maine of all orders, and lists eighty species as previously unrecorded thereon. He discusses those he has reared, especially the ones of economic importance. In his compendium he lists alphabetically according to species the blueberry and huckleberry insects of America and Europe.

New Jersey Species

Conditions in New Jersey, especially in the cultivated areas, being so dissimilar from those pertaining to the low-bush regions of the north, a wide variance in the insect population of the two regions would naturally be expected. I have listed, with comments, the Lepidoptera recorded as feeding on blueberries (commonly called huckleberries in New Jersey), together with such rearing records as I have been able to obtain. I have also listed, regardless of food plant, some Lepidoptera that can be found in the cultivated blueberry fields, as without comment they might be considered blueberry feeders.

The species are numbered, after their names, according to the McDunnough Check Lists of the Lepidoptera of Canada and the United States, 1938-1939.

With the exception of the fruitworm (*Mincola vaccinii* Riley), no Lepidoptera are of much economic importance in this connection. The same cannot be said about some of the other orders, which embrace families of such great economic importance to the

[2] Chandler, F. B., Bull. Maine Agr. Exp. Stat., no. 423, 1943.

[3] Phipps, Bull. Maine Agr. Exp. Stat., no. 356, 1930.

industry as to cause the maintenance of a fully staffed "Cranberry and Blueberry Research Laboratory", at Pemberton, New Jersey, for the study and control of cranberry and blueberry pests and diseases. This work was started at Whitesbog, New Jersey, in 1914.

Much valuable information concerning the Macrolepidoptera was received from the unpublished records of Otto Buchholz, Roselle Park, New Jersey, and the late Frederick Lemmer, of Lakehurst, New Jersey, where much of their collecting was done.

The Butterflies

The larvae of a few butterflies are recorded by various observers as blueberry feeders.

Nymphalidae

Basilarchia astyanax Fabricius (322)

A common species, having a wide distribution over the United States and southern Canada. A general feeder; recorded on huckleberry. Holland, 1914, pp. 183-184.

Basilarchia archippus Cramer (325)

Another general feeder having a number of varietal forms. The usual foods are willow and poplar, but it is recorded on huckleberry; Smith, 1909, p. 412.

Lycaenidae

Strymon liparops Boisduval and LeConte (389)

The form *strigosa* Harris, has been reared on blueberry. "Egg laid singly on terminal twig of swamp blueberry (*Vaccinium corymbosum*)"; W. P. Comstock, 1940, p. 63. Recorded from Lakehurst, New Jersey, in July; F. Lemmer.

Incisalia irus Godart (405)

On huckleberry; Smith, 1909, p. 415. Comstock does not mention blueberry as a food; Comstock, 1940, p. 64.

Incisalia henrici Grote and Robinson (407)

"Rare. One brood. Huckleberry (*Gaylussacia resinosa*)"; Comstock, 1940.

The Larger Moths (Macrolepidoptera)

Sphingidae

Sphinx gordius Cramer (728)

Larva until frost on huckleberry and bayberry; Smith, 1909, p. 429. On huckleberry in late fall, but rare; Buchholz.

Paonias astylus Drury (743)

On huckleberry in late fall; Smith, 1909, p. 430. Rare in this locality; Buchholz.

The following observations on this species were made by F. M. Jones (1890, Ent. News, vol. I, pp. 21-22): On June 16, 1889, he found a male & female on a twig of high-bush huckleberry. Here and there on all the bushes hung a few dry leaves; the leaves when dead turn a cinnamon-brown and the two moths, as they sat motionless so closely resembled one of these dry leaf clusters, both in color and outline, that he did not recognize them as living insects at first sight. June 16 to 19 the ♀ laid 151 smooth, glossy, pale greenish yellow eggs, somewhat flattened, 2 mm. in greatest diameter. June 23, some of the eggs changed to dirty white and the young larvae could be seen within. June 24, eggs commenced to hatch; young larva pale greenish white, 6 to 7 mm. long; head and thoracic segments large; caudal horn 1.5 mm. long, reddish brown, darker at base and tip; two spines at tip making it appear pronged; horn usually straight or nearly so, in this moult pointing backward. July 28, larvae full grown, 38 mm. long, green, with yellow granulations; seven yellow, oblique lateral stripes, the last reaching the base of the caudal horn; an indistinct yellow, longitudinal, lateral line to fifth segment and continued faintly; a variable number of red dorsal spots or blotches, two on a segment; some have but two small red spots on the third segment while on others red is the predominating color of the dorsal region; caudal horn straight, pale green, with two thorns at tip pointing forward; several days before pupating the green of the dorsal region fades to a dull yellow. Aug. 11, first larva pupated on surface of soil.

Hemaris gracilis Grote and Robinson (768)

A general feeder, not previously recorded on blueberry. In the summer of 1945 I found a larva feeding on blueberry, and a male moth emerged June 16, 1946.

Superfamily NOCTUOIDEA

The members of this superfamily are not troublesome in cultivated fields, nor on the wild bushes in New Jersey, but on the blueberry "barrens" of Maine they are of economic importance.

Arctiidae

Halisidota tessellaris Smith and Abbot (984)

A general feeder that has been found on blueberry. Easily confused with *H. harrisii* Walsingham, which feeds on sycamore.

Estigmene acrea Drury (1070)

A general feeder that was reared on blueberry; Phipps, 1930, p. 179. New Jersey records are, that it will feed on anything if caged.

Hyphantria cunea Drury (1075)

Smith, 1909, pp. 437, 439. As there are two generations annually our species is *cunea*; *H. textor* Harris, having only one generation. This so called "fall web-worm" is capable of doing considerable damage if the nests are not destroyed. The spring brood is the destructive one on the cultivated blueberry.

Phalaenidae

Acronicta tritona Hubner (1159)

A general feeder on ericaceous plants; Smith, 1909, p. 445. I have no actual record on blueberry.

Acronicta brumosa Guenée (1199)

Buchholz has taken the larva on huckleberry, but rarely.

Acronicta lanceolaria Grote (1216)

Twice I have found the larva feeding on blueberry; in both cases pupation was between dead leaves at the bottom of the cage; one moth emerged June 9, the following year, the other emerged August 12 in another year, indicating two broods. Not listed as a species found in New Jersey, nor is it recorded as a blueberry feeder in Maine.

Harrisimemna trisignata Walker (1223)

A spectacular species coming to light, and recorded on huckleberry; Smith, 1909, p. 446. "In fifty years collecting I have found but one larva, (on *Viburnum*) and reared it to maturity"; Buchholz.

Actebia fennica Tauscher (1452)

Periodically destructive in Maine; Phipps, p. 154. Not recorded by Smith (1909, Report N. J. State Mus.), but I have taken it at light within the state. Buchholz records only one specimen from New Jersey.

Rhynchagrotis anchocelioides Guenée (1604)

Known in New Jersey as the "blueberry bud worm"; Beckwith, 1940, p. 19.

The worms hide in the trash beneath the bushes during the day and travel up the stems at night to feed on the tender young buds, starting at the tip. There seems to be no evidence that they cut the buds off and drop them to the ground as the cranberry blossom worm does. Good cultural methods are the solution.

Polia lutra Guenée (= *lubens* Grote) (1699)

Recorded on huckleberry; Smith, 1909, p. 457.

Psectraglaea carnosa Grote (2292)

A light pink species blending well with the red blueberry foliage in the fall and presumed to be a blueberry feeder. "Reared larvae refused blueberry but fed readily on wild cherry"; Buchholz.

Homoglaea hircina Morrison (2324)

W. T. Davis reported it feeding on huckleberry leaves at Lakehurst, New Jersey. Smith records it on huckleberry leaves; Smith, 1909, p. 466.

Lemmer collected extensively at Lakehurst and neither he nor Buchholz have taken it within the state. Davis' record refers to one adult specimen taken in September.

Elaphria grata Hubner (= *Oligia grata*) (2650)

Smith, 1909, p. 448. A common species, on the wing from early spring to late October. I have reared it on blueberry; imagos emerging in September.

Catocala sordida Grote (3385) and **Catocala gracilis** Edwards (3386)

These are blueberry feeders in May. The larvae are hard to find and there is no evidence of extensive feeding. The moths come freely to bait.

Philometra metonalis Walker (3770)

M. V. Slingerland (Can. Ent. XXIX, 1897, pp. 49 to 52) stated that on May 20, 1896, he received from a correspondent in Mount Vernon, N. H., some worms that were making sad havoc with the blueberry crop in that section. They seem to be great feeders, completely stripping the bushes of leaves and blossoms but do not touch the green berries after they begin to form. The berry fields look as though a fire had passed over them and the worms have nearly ruined the crop (on *Vaccinium pennsylvanicum*). A photographic plate accompanies the article and the larva is described.

I have taken the species at light during August and September at New Lisbon, but have no record of its feeding on blueberry.

Notodontidae

Datana major Grote and Robinson (3832)

This is the common *Datana* on blueberry but it never is of great economic importance. *D. drexeli* Hy. Edwards and *D. palmi* Beutenmuller may at times feed on blueberry.

Hyparpax aurora Smith and Abbot (3865)

The principal food seems to be oak, but I found the larvae feeding on blueberry, August 11, 1950.

Schizura ipomoeae Doubleday (3920)

A general feeder, recorded on huckleberry; Smith, 1909, p. 489.

I have reared the form *cinereofrons* Packard on blueberry, with emergence in August.

Schizura unicornis Abbot and Smith (3924)

One specimen reared on blueberry, with emergence July 20.

Superfamily Bombycoidea

Lasiocampidae

Malacosoma disstria Hubner (3997)

This "forest tent-caterpillar" may do great damage in its migratory passage over a field, but it is not essentially a blueberry feeder. Noted by C. S. Beckwith, 1940 (N. J. Dept. of Agr., "Insects of the Cultivated Blueberry," p. 20).

Superfamily Geometroidea

Geometridae

Sterrhinae

Scopula enucleata Guenée (4149)

A general feeder, recorded on blueberry; Smith, 1909, p. 498. Reported common on huckleberry; Beutenmuller, 1890, p. 221. Taken on the wing in New Jersey, June through August.

Cosymbia myrtaria Guenée (4209)

On huckleberry; Smith, 1909, p. 498. On huckleberry and sweet fern; Beutenmuller, 1890, p. 221. On the wing from mid April to mid September.

Larentiinae

Lygris diversilineata Hubner (4401)

The form *gracilineata* Guenée, is reported as a *Vaccinium* feeder.

Eulype hastata Linnaeus (4573)

A general feeder, recorded on huckleberry; Smith, 1909, p. 496.

Ennominae

Semiothisa bicolorata Fabricius (4673)

On huckleberry; Smith, 1909, p. 501.

Glena cognataria Hubner (4882)

I have reared the species from larvae feeding on the foliage of cultivated blueberry, imagos emerged in early August.

Vitrinella pampinaria Guenée (4908)

A general feeder, blueberries included.

Metarranthis obfirmaria Hubner (5052)

It feeds on a variety of ericaceous plants; Smith, 1909, p. 507. Buchholz has reared it on blueberry.

Cingilia catenaria Drury (5152)

On *Vaccinium;* Smith, 1909, p. 505.

Microlepidoptera

The author's chief contribution to this study deals with the Microlepidoptera. As William T. M. Forbes in "The Lepidoptera of New York and Neighboring States" (Cornell Univ. Agr. Exp. Stat., Mem. 68, 1923), has given terse descriptions of all listed species, we suggest that the student consult this as the best all-inclusive publication. Page numbers to the Forbes paper are here shown.

Superfamily ZYGAENOIDEA

Limacodidae

Sibine stimulea Clemens (5230) (Forbes page 106)

A general feeder, found most frequently on oak, but it takes readily to blueberry.

Parasa indetermina Boisduval (5231) (Forbes page 107)

A general feeder that I have reared on blueberry; so has F. M. Jones, at Wilmington, Delaware.

Euclea delphinii Boisduval (5234) (Forbes page 107)

A general feeder on various trees and shrubs. Gradations in maculation are responsible for names of several forms. I have reared it on blueberry and oak.

Prolimacodes badia Hubner (5260) (Forbes page 110) (=*P. scapha* Harris)

A general feeder that I have reared on cultivated blueberry and various other plants.

Lithacodes fasciola Herrich-Schaeffer (5266) (Forbes page 112)

A general feeder, recorded on huckleberry; Smith, 1909, p. 513.

Packardia geminata Packard (5272) (Forbes page 112)

A general feeder, reared on blueberry.

Tortricidia testacea Packard (5279) (Forbes page 111)

A general feeder, reared on blueberry. *P. germinata* seems to be the light form and *P. albipunctata* Packard, the dark form of this species.

Megalopygidae

Lagoa crispata Packard (5286) (Forbes page 102)

Feeding on a variety of plants, including blueberry, but not in sufficient numbers to be of economic importance. At first the larva is a white fluffy ball resembling a bit of down, later it elongates and at maturity is covered with a thatch of reddish hairs that meet to form a crest along the dorsum.

Superfamily Pyralidoidea

Pyralididae

Crambinae

Prionapteryx nebulifera Stephens (5841) (Forbes page 588)

A sub-tropical species, the larva not living in the immediate feeding area but on the ground, and like the termites forming a protecting tunnel of silk and sand extending up the stem of the plant upon which it desires to feed. It feeds at night on the leaves of low sand-barren plants, especially sand myrtle and low huckleberry, spending the day in its hibernaculum in the sand at the base of the plant.

Phycitinae

Mineola vaccinii Riley (6114) (Forbes page 619)

1948. *Mineola vaccinii* H. J. Franklin, "Cranberry Insects in Massachusetts", Mass. Agr. Exp. Stat. Bull. 445, pp. 51-56.

The only Lepidoptera to become a real blueberry pest, now being well controlled by the modern insecticides. It is known in Massachusetts as the "Cranberry Fruitworm", where it has been very destructive, having taken as much as half of that crop. On blueberry its work can be noted by the premature coloring of the fruit. We formerly sent women into the fields to gather these berries and

dump them into drums containing kerosene or thin oil; if dumped into dry containers the worms, which always leave the berries soon after they are picked, will crawl out and if mature enough will form a hibernaculum, thus defeating your efforts. The larva enters the berry and eats the seeds and pulp, then enters an adjacent berry, and so on, webbing up part or all of a small cluster. Pupation is in an oval cocoon of sand and silk, the pupa being surrounded by air. Moths begin to emerge by the first of June; they are very secretive and are seldom seen, and very rarely come to light.

Tlascala finitella Walker (6177) (Forbes page 624)

We have reared the species on blueberry and cranberry; the larva feeds on the young tender growth and is very active when disturbed. Pupation in an oval soil cocoon. Imagos, June 10 to July 23.

Laodamia fusca Haworth (6227) (Forbes page 628)

Reared by Philip Laurent on blueberry, at Anglesea, New Jersey. On *Vaccinium;* Smith, 1909, p. 534.

Moodna ostrinella Clemens (6396) (Forbes page 636)

Though not a blueberry feeder we have taken it in the blueberry fields. Clemens described the larva and moth and evidently reared it in fruit panicles of sumac. We have also reared it in panicles of *Rhus glabra.* Murtfeldt reports it in acorns; it may get to the blueberry fields from the surrounding oaks.

Superfamily Tortricoidea

Tortricidae

Olethreutinae

Zomaria interruptolineana Fernald (6635) (Forbes page 457)

Binding young leaves of huckleberry; Smith, 1909, p. 540. We have found the larva between young gummed leaves. Pupa in the feeding area. Imagos, June 20 to July 3.

Common on the wild blueberries at Martha's Vineyard, Massachusetts, where it pupates between the leaves, the imagos emerging in late July, and August.

Exartema sericorana Walsingham (6691) (Forbes page 466)

Cymolomia myricana Kearfott (manuscript name), in Smith, 1909, p. 539.

1942. *Exartema myricana* Klots, Bull. Amer. Mus. of Nat. History, LXXIX, p. 406.

1926. *Exartema sericoranum* Heinrich, Bull. U. S. Nat. Mus., 132, p. 152.

I have reared this species in webbed tips of *Myrica carolinensis,* and as this plant grows on the borders of many of our cultivated blueberry fields the moth might be found flying over the bushes and easily mistaken for any species with a similar *Cymolomia* pattern. I have also reared the species on Stagger-bush (*Andromeda mariana*).

Exartema permundana Clemens (6696) (Forbes page 466)

1926. *Exartema permundanum* Heinrich, Bull. U. S. Nat. Mus., 132, p. 155.

1942. *Exartema gaylussaciana* Klots, Bull. Amer. Mus. of Nat. History, LXXIX, pp. 402-403.

Reported as a general feeder having a great variety of hosts. Kearfott reared it in Essex County, N. J., on huckleberry.

Our species in South Jersey is *Exartema baccatanum* McDunnough.

Exartema baccatanum McDunnough

1942. *Exartema baccatanum* McDunnough, Can. Ent., LXXIV, p. 65.

The type series of this species was bred from larvae tying the terminal shoots of *Gaylussacia baccata.* Active larvae yellow-green, much the color of the plant leaves; black head and prothoracic shield.

Olethreutes cespitana Hubner (6728) (Forbes page 453)

[=*O. instrutana* Clemens.]

A general feeder, found in the blueberry fields, but not reared on blueberry. On the wing from June 1 to late August.

Strepsicrates smithiana Walsingham (6769) (Forbes page 436)

[=*P. indentanus* Dyar.]

Recorded by Kearfott as webbing leaves of huckleberry and bayberry; Smith, 1909, p. 547.

Anchylopera nubeculana Clemens (7175) (Forbes page 408)

"A leaf crumpler or folder on apple." I have reared it on blueberry; emergence the last of July.

Anchylopera subaequana Zeller (7176) (Forbes page 408)

One specimen reared from a pupa between two attached blueberry leaves; imago appeared August 9th. The larva probably feeds under the protection of a folded over leaf.

Ancylis muricana Walsingham (7196) (Forbes page 406)

[= *A. cornifoliana* Riley]

I have reared it on blueberry. Imagos appear in May, June and August.

Laspeyresiinae

Grapholitha molesta Busck (7242) (Forbes page 394)

This is the oriental fruit or peach moth, probably introduced from Japan about 1913. It was found in 1916 in the District of Columbia, Maryland and Virginia. It feeds on a variety of fruits of economic importance, including blueberry. In this locality there are three, and possibly four, broods per year. One female may produce as many as 140,000 eggs during a year. The larvae hibernate in trash, under bark, in mummied fruit, in buildings, or in soil-covered cocoons; pupating in early spring. The first moths emerge with the blossoming fruit, and the whitish eggs are laid chiefly on the leaves. The first brood, and possibly the second, burrows into the tender twigs; later on when fruit is formed, they feed on it. Moths reared from larvae boring into peach twigs emerged June 10 to 15. Moths have emerged by the middle of May from larvae that have pupated in our attic. On clustered fruit like the blueberry, the larva passes readily from one berry to the next, gumming the two or more berries together, with the extrusion of some frass. Larvae that have fed on the fruit and pupated in soil-covered cocoons, have emerged as adults in September.

Grapholitha packardi Zeller (7244) (Forbes page 395)

[= *Laspeyresia pyricolana* Murtfeldt.]

1926. *Grapholitha packardi* Heinrich, Bull. U. S. Nat. Mus., 132, pp. 29-30.

"A species of some economic importance as an enemy of apple. The larva is apt to be confused with that of *molesta* which it much resembles. It usually attacks the growing twigs, seldom the fruit." Rather common on blueberry, boring into the young and often the older canes; it is also a fruit worm, often leaving the berries when mature and boring into the wood of the blueberry crates where it pupates. Imagos appear from the middle of May through July. The moth is slightly smaller than that of *molesta* and the male has a strong patch of black sex scaling on the upper surface of the hind wing and a similar patch on the under surface of the fore wing. I have also reared the species from Uva-Ursi fruit, pupation outside the berry, emergence June 29 and September 13.

Tortricinae

Amorbia humerosana Clemens (7314) (Forbes page 479)

Recorded on huckleberry; Smith, 1909, p. 550. Reported on a variety of plants, but I have no record on blueberry.

Sparganothis pettitana Robinson (7317) (Forbes page 477)

A general and common feeder. Larva found on the tender foliage of blueberry. Pupation in the feeding area. Imagos appear in June and early July.

Sparganothis pupal cases can be recognized by the two rows of sharp, stiff, spiny ridges to each segment.

Sparganothis karacana Kearfott (7322) (Forbes page 477)

A general and common feeder. On blueberry, with larva in webbed young foliage; pupation in the feeding area. Imagos in July and early August.

Sparganothis reticulatana Clemens (7323) (Forbes page 477)

A general feeder, reared on blueberry, also on wild cherry.

Sparganothis diluticostana Walsingham (7325) (Forbes page 477)

A general feeder that I have reared only on blueberry, though reported as common on oak and wild cherry. Pupates in a rolled leaf. Imagos appear in July.

Sparganothis directana Walker (7326)

1863. *Teras directana* Walker, Cat. Lepid. British Mus., XXVIII, p. 309.

The larvae feed on the young leaves of low-bush blueberries. Pupation is between two appressed leaves in the feeding area. Imagos appear in June and early July. A favored food is *Gaylussacia frondosa*.

Sparganothis testulana Zeller (7327) (Forbes page 478)

A somewhat general feeder; reared on low-bush blueberry and on cranberry, the larvae feeding on the young leaves webbed loosely together, similarly to *directana*; pupation in the feeding area, or under any protection. Imagos appear in June and July; red-orange in color, without a defined fascia; rugose, causing color refractions.

Sparganothis sulfureana Clemens (7349) (Forbes page 476)

1938. *Sparganothis sulfureana* C. S. Beckwith, Jour. of Econ. Ent. xxxi, pp. 253-256.

A very variable species having a wide distribution and feeding on most any plant, which may account somewhat for the variations in size and general pattern. At times very destructive on cranberry bogs, but never of economic importance on blueberry.

Types of *sulfureana*, *fulvoroseana*, *virginiana* and *gallivorana* Clemens are in the collection of the Academy of Natural Sciences of Philadelphia.

Platynota flavedana Clemens (7357) (Forbes page 479)

A general feeder on low plants. We have reared it from webbed cranberry tips, and as a leaf feeder and fruit worm on blueberry. Imagos appear June 3 to August 1.

Type, no. 7268, Acad. of Nat. Sci., Phila. Robinson's lectotype of *Tortrix laterana* is also in the Academy's collection.

Platynota idaeusalis Walker (7369) (Forbes page 478)

Reported on *Vaccinium*. We have not reared it on blueberry.

Archips obsoletana Walker (7381) (Forbes page 494)

A general feeder that we have reared on blueberry.

Distinguished by the two blue-black spots in the costal fasciae of the fore wing, and one in the central fascia at the anal angle.

Archips georgiana Walker (7385) (Forbes page 498)

A general foliage feeder that we have reared on many unrelated plants, including cranberry, blueberry, oak, sassafras, sweet fern, *Franklinia, Rhus copallina,* and *Kalmia latifolia.* Larvae appear in early June on blueberry, pupae in mid and late June, imagos in late June to early July. Smith does not record the species in "Insects of New Jersey."

Forbes records it at Lakehurst and Whitesbog, N. J., in July. Whitesbog has been the center of our collecting area.

Archips purpurana Clemens (7399) (Forbes page 495)

A general feeder. Recorded on huckleberry; Smith, 1909, p. 549.

Archips rosaceana Harris (7405) (Forbes page 496)

A common species that feeds on most any plant, blueberries included.

Tortrix peritana Clemens (7420) (Forbes page 489)

A general feeder. One specimen reared on blueberry foliage, imago appeared August 10.

Argyrotaenia velutinana Walker (7443) (Forbes page 490)

A general feeder, a leaf roller, blueberry included.

As seen from their types *lutosana* and *incertana* Clemens are the same as Walker's species.

Argyrotaenia mariana Fernald (7450) (Forbes page 491)

Reared on *Vaccinium;* Smith, 1909, p. 550.

Argyrotoxa albicomana Clemens (7469) (Forbes page 480)

Larva on oak, rose, huckleberry, etc.; Smith, 1909, p. 550.

Argyrotoxa semipurpurana Kearfott (7470) (Forbes page 481)

The one specimen reared on blueberry has very dark-purplish fore wings, with the base, outer margin and costal margin yellow; the oval yellow patch is in the center of the wing. Pupation takes place at the feeding area. Imago appeared June 20.

Peronea maculidorsana Clemens (7497) (Forbes page 486)

A fairly common blueberry feeder. The larva gums the young leaves and tips together and feeds on the leaves and often the fruit.

Imagos appear as late as December. Hibernating adults have been taken on the wing the first warm days in March, before the leaves have developed for feeding.

Superfamily Gelechioidea

Gelechiidae

Aristotelia rubidella Clemens (7818) (Forbes page 295)

Plentiful in some blueberry fields but not observed as a blueberry feeder.

Telphusa latifasciella Chambers (7952) (Forbes page 292)

"Larvae web young leaves of huckleberry in May, issue in June"; Smith, 1909, p. 555.

The species is normally an oak feeder; I have not reared it on blueberry.

Gelechia trialbamaculella Chambers (7965) (Forbes page 265)

Common on blueberry, cranberry and many other ericaceous plants. Cranberry growers call it the Red-striped Fireworm. (See H. J. Franklin, 1948, Bull. Mass. Agr. Exp. Stat., 445, pp. 12-14, with illustrations.)

The mature larva has two dorsal and two lateral dull red stripes; there are no setiferous tubercles between the two dorsal stripes; between the dorsal and first lateral there are two small black tubercles per segment, from the fourth to eleventh segments; between the two lateral segments there is one tubercle per segment; the second lateral stripe is often lighter in color and somewhat wavy, with one tubercle per segment below it. The later in the fall the larva feeds the more intense the red color. Immature larvae are greenish yellow, becoming pink. On blueberry the larva gums two to three succulent leaves flatly together, and in the center of the feeding area forms a silk-lined tubular retreat, covered with castings. Late hatching larvae will feed as long as the foliage remains attractive, and the skeletonized leaves will hang to the bush after the other leaves have fallen. Most larvae hibernate in the trash, and pupate irregularly during the spring, but a few will remain to feed again for a short time in the spring, thus producing a more or less continuous emergence. Adult larva, 12 mm.

The species has but little economic importance, on well-handled properties.

Telephila vacciniella Busck (8290) (Forbes page 285)

1909. *Dichomeris vacciniella* Kearfott (a manuscript name) in Smith, p. 559.
1915. *Dichomeris vacciniella* Busck, Proc. Ent. Soc. Wash., XVII, p. 83.

Kearfott reported the larvae folding or crumpling the leaves of huckleberry; Smith, 1909, p. 559.

A very distinct species, described from Pemberton, N. J., "bred by Mr. Scammell from cranberry."

Busck was very much in error, in the above quoted statement, as the species was reared on blueberry, not cranberry, and the material must have been collected on our plantation at Whitesbog, New Jersey (now a Post Office), for in 1914 we were the only blueberry culturists, and ten miles from Pemberton.

Scammell's brief notes as follows.—"1914, green larva with black head and thoracic shield, found in webbed foliage of blueberry in early June. Caged material pupated June 18 to 20; moths July 9 to 18."

The forewings in this species vary from dark brown to shining reddish-brown or russet, the general appearance being one of reddish iridescence; there is considerable irregular dusting in the light colored specimens, not noticeable in the dark ones; there are four, round black dots, more or less edged with white, one before the cell, one in the cell, one at the end of the cell and one in the fold below and basal to the second dot. It is usual for the veins to be terminally marked with black scales; on the under side the veins are distinctly outlined; with the exception of the four dots there are no consistent markings. The purple suffusion may be noticeable or very slight. The hindwings are dark, and generally more so at the apex, where the cilia is darker also. Fore and middle legs suffused exteriorly with black, with yellowish tarsal annulations; the outer tibial spurs on the hind legs are blackish on the outer side. Expansion, 18 mm.

Larva: green, often turning pink; head and first segment black, first pair of legs black; six long setae on anal segment and three setae on each anal proleg; feeding in a cylindrically folded leaf, or between two cupped leaves, the top of the cylinder or cup

remaining slightly open as an egress to the feeding area and also serving as a means of escape. Caged larvae pupate between leaves, in the trash, or under any protection; in the field pupation is always in a cluster of dead leaves, generally around the base of the plant where the leaves collect.

Some years the species is very abundant on cultivated blueberries, such as on June 9, 1944; and then it may nearly disappear.

Dichomeris georgiella Walker (8303) (Forbes page 285)

"Bred from larva on blueberry (*Vaccinium corymbosum*), at Whitesbog, New Jersey, by H. B. Scammell"; H. B. Weiss, 1917, Ent. News, XXVIII, p. 219.

Considered the same species as *D. ventrella* Fitch (8298), which I have reared on oak but never found on blueberry.

Oecophoridae

Machimia tentoriferella Clemens (8383) (Forbes page 235)

1860. *Machimia tentoriferella* Clemens, Proc. Acad. Nat. Sci., Phila., 1860. p. 212.

A general feeder that we have reared on blueberry, oak, maple and honey locust. The larva makes a tubular-like silken runway, generally along the midrib on the under side of a leaf; this runway serves as a protection and is open at both ends to permit egress for feeding. The larva may leave this thin transparent runway to form one on another leaf. In September or October it makes a pupal case in a tightly rolled edge of a leaf.

Clemens in the above citation gives a full description of the larva and its habits.

Stenomidae

Stenoma algidella Walker (8585) (Forbes page 252)

A general feeder, reared on white birch, *Aronia*, *Gaylussacia*, blueberry.

Head and face white, with appressed scales. Palpi awl-like, porrect. Antennae whitish, especially towards the base. Patagia white. Fore wings white, with underlying irregular slate-colored patches, especially in the fold and along the dorsal margin; the largest patch at about one-half the length, like the rest, does not

reach the costa, it encloses two darker, connected spots, extending above and below the fold; at three-fourths the length is an excurved crescent-shaped shading, far from reaching the costa but reaching the dorsal margin; six irregular black dots or blotches precede the cilia; an irregular row of black scales at base of cilia, followed by a band of white, and tipped completely around by a band with a metallic luster; above the anal angle are a few brush-like black scales, and, in some specimens, a few along the inner margin. Hind wings uniform light gray, cilia white. Anal tuft white. Fore legs smoky; middle pair white with smoky tarsi; hind pair white with white tarsi.

Larva; green, with very dark orange head and a white stripe across the face; the tubercles bear long setae.

Pupation in the feeding area, amongst the leaves.

Moths emerged from May 15 to August 4. Expansion, 17 to 24 mm.

Coptodisca magnella Braun (8994) (Forbes page 228)

1916. *Coptodisca magnella* Braun, Can. Ent., XLVIII, p. 138.

"This is the largest species of this genus; distinguished chiefly by the pale basal half of fore wing, and the fact that the dark dorsal patch never extends nearer to the costa than the apex of the dorsal silvery spot, and therefore the ground color extends without interruption between the silvery spots to the termen beneath the apical spot.

"The mine starts as a narrow linear, which enlarges to a semi-transparent blotch 10 by 3 to 4 mm. The elliptical pupal case is attached by a silken band to a leaf or twig."

Collected by Dr. Braun the latter part of August, in Ohio, on *Gaylussacia baccata* (Wang.) K. Koch (a common woodland blueberry in New Jersey). Moths emerged in May of the following year.

Related to *Coptodisca ostryaefoliella* Clemens, which Dr. Braun has redescribed (1916, Can. Ent., XLVIII, p. 139).

Superfamily TINEOIDEA

Coleophoridae

Coleophora gaylussaciella Heinrich (9073) (Forbes page 212)

1915. *Coleophora gaylussaciella* Heinrich, Insect. Insc. Mens., III, p. 143.

A blueberry feeder. Heinrich reports one adult reared from larva taken in Virginia. It might occur in New Jersey.

Gracillariidae

Lithocolletis diversella Braun (9188) (Forbes page 193)

1916. *Lithocolletis diversella* Braun, Ent. News, XXVII, p. 83.

Dr. Braun reared the species on *Gaylussacia baccata,* and on *Oxydendrum arboreum* (sorrel tree).

On *Gaylussacia baccata,* the mines were collected in Ohio, August 21; the imagos appeared August 31, the same year. A tentiform mine is formed on the under side of the leaf, one-half of the mine is partitioned off to form a pupal chamber.

As the records from Ohio and New Jersey differ somewhat we will endeavor to reconcile the two as applying to the same species. At New Lisbon, N. J., the species was reared on *Vaccinium corymbosum* (our cultivated blueberry), in a slight tentiform mine on the under side of a leaf; there was no visible way to distinguish the mine from that of *Callisto preciosella* Dietz, excepting that there was no exit hole from which the larva had emerged.

Braun states that on sorrel tree (*Oxydendrum arboreum*), emergence was not until May 10, the year following. The original description of this material is as follows: "palpi whitish, face metallic golden, tuft dark brown; antennae dark gray, with the eight or nine segments preceding the apex whitish; the terminal segment dark." (On the blueberry one the tuft is reddish ocherous, antennae pale gray throughout.) "Thorax deep metallic golden, this color extending onto the extreme base of the fore-wings, which elsewhere are golden or reddish brown, but not metallic. The coloring is identical with that of *L. ostensackenella.* (In the other specimen [the one on blueberry] the scales of the thorax and fore-wings are identical in structure; the color a little paler and more ocherous.) The markings of the fore-wings,

which are lustrous white in one specimen, scarcely shining in the other, are placed as follows: A very short basal streak just above the fold, margined with dark brown toward the costa; an almost straight fascia at one-third dark margined internally; two posterior costal and two dorsal spots, internally margined; the first dorsal spot with its apex projecting a little beyond the corresponding but smaller costal spot; the second pair of spots curved and almost meeting. A dark brown irregular apical spot preceding and encroached upon by a streak of white scales. Cilia golden, gray toward the tornus; terminal line of scales dark brown. Hind wings gray, tinged with red. Legs dark brown, spurs and terminal segments of tarsi whitish or silvery. Abdomen dark brown, whitish or silvery beneath. Expanse: 5 mm. (male), 7 mm. (female)."

In New Jersey specimens the left antenna will vary from the right in markings; the tuft from dark brown to jet black. The fore wings are reddish golden and you might say metallic. The lustrous white markings are rather wide and well margined internally with black, with some projection to the under side. Thorax shining black. Cilia gray throughout, not golden. The red tinting on the hind wings is so faint as to be overlooked. The entire moth has a metallic appearance. The species was discovered accidently while searching for *Callisto* miners, and was never found except in late October. Pupation in the mine; one emergence April 11, the rest in June.

Callisto preciosella Dietz (9332) (Forbes page 167)

1907. *Ornix preciosella* Dietz, Trans. Am. Ent. Soc., XXXIII, pp. 291-292.

"On *Vaccinium corymbosum*"; the blueberry of cultivation.

Dietz figures the species very accurately, but a good series of reared material may show variations in coloration; the vertex may be decidedly black and not interspersed with white; the tuft and antennae also black; the forewings bronze-black; legs, femora and tibiae black, tarsi of the fore and middle legs white, annulate with black, hind legs with black tarsi annulate with white.

A mine is often started before the leaf is fully developed. At maturity the larva leaves the mine through a puncture at one end, the epidermis at this time is light tan in color and the mine slightly puckered, making it noticeable on the upper side of the leaf which

generally indicates an empty mine. In confinement pupation is in a tightly formed case on the edge of a leaf other than the one mined; in nature pupation is on the ground; years of careful observation have failed to show any attempt at pupation on the bush. Imagos appear from May 30 to July 30. Larvae in the mines found as late as November 5. Fall larvae will occasionally pupate in the mine and will remain inactive in the mine longer than a summer brood.

C. preciosella also feeds on wild cherry (*Prunus virginiana*), the leaf being slightly more puckered, the mine usually based on the midrib and extending out between two or more lateral ribs. Imagos appear in May.

Callisto arbitrella Dietz (9337) (Forbes page 167)

1907. *Ornix arbitrella* Dietz, Trans. Am. Ent. Soc., XXXIII, p. 293.

"Two specimens bred from *Vaccinium corymbosum*. Hab.—Penna." No New Jersey record.

Gracilaria vacciniella Ely (9357) (Forbes page 174)

1915. *Gracilaria vacciniella* Ely, Insect. Insc. Mens., III, p. 52.

At first a leaf-miner, it soon becomes a surface feeder and protects itself in a unique manner by drawing the tip of the leaf over to a point along the edge and fastening it down with a silk thread, forming a triangular tent-like enclosure in which it feeds until mature. When mature the larva leaves its enclosure and pupates on the under side of a leaf in a split capsule-like case that slightly puckers the leaf; two or more larvae may pupate on the same leaf. It is said that the larva may pupate at times within its enclosure but I have never found it so. Viable larvae may be found in their enclosures when the leaves fall at the end of the season, then they pupate in the trash on the ground. Imagos occur from the last of May until the first of August. Common on *Vaccinium corymbosum*.

Gracilaria burgessiella Zeller (9361) (Forbes page 173)

1915. *Gracilaria burgessiella* Ely, Insect. Insc. Mens., III, p. 51.

Larva on swamp huckleberry (*Vaccinium corymbosum*); Smith, 1909, p. 572.

"Food.—*Cornus candidissima;* July 26 to August 1. Under side, narrow and winding mine at first, but quickly terminating in a small, elongated blotch, next to a rib or vein. After emerging from the mine the larva rolls the tip of the leaf downwards into a small cone. It leaves the cone to spin its cocoon, which is similar to those of our common maple and willow feeders. Not common and generally confused with other species."

Tischeriidae

Tischeria malifoliella Clemens (9508) (Forbes page 147)

The mines were along the edges of cultivated blueberry leaves (*V. corymbosum*), upper side, producing a slight roll to the leaf edge. The larvae were still active when disturbed in mines November 10. Imagos appear in early June. The forewing has a purplish iridescence, not golden, as noted by Forbes. Of course this species might be *T. roseticola* Fray and Boll, as the face is decidedly yellow.

Psychidae

Thyridopteryx ephemeraeformis Haworth (9519) (Forbes page 144)

When in great abundance it reaches the blueberry bushes.

Superfamily Incurvarioidea

Incurvariidae

Paraclemensia acerifoliella Fitch (9817) (Forbes page 76)

1928. *P. acerifoliella* Needham, leaf Mining Insects, p. 79.

"Leaves of the infested tree present a strange appearance; they are perforated with numerous elliptical holes, marked by many more or less perfect ring-like patches in which the green matter of the leaf has been destroyed, but each of which incloses an uninjured spot. These injuries are produced as follows. The young larva cuts an oval piece from a leaf, places it over its back and fastens it down with silk around its edges. This serves as a house beneath which it lives. As it grows the house becomes too small. It then cuts out a larger piece which it fastens to the outer edges of the smaller one, the larva being between the two. Then it fastens one edge of the case to the leaf by a silken hinge so that

it will not fall to the ground, then it turns the case over so that the larger piece is over its back. When it wishes to change location it thrusts out its head and fore legs from the case and walks off looking like a tiny turtle. When it feeds it fastens the case to a leaf and thrusts out its head and eats the fleshy part of the surrounding leaf. The mine is at first irregular linear, tending to become a blotch. Mine on upper side of leaf. Feeds, July, August and September. Hibernates in its pupal case amongst the fallen leaves. Emergence in late spring. Moth brilliant steel blue with violet reflections, and a tuft of orange-yellow hairs upon the head."

I have specimens reared on white birch, oak and blueberry.

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THE LESTES DISJUNCTUS AND FORCIPATUS COMPLEX (ODONATA: LESTIDAE)

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(Figures 1 to 13)

The separation of the two North American species of *Lestes*, *L. disjunctus* Selys and *L. forcipatus* Rambur, formerly thought to be simple and definite, has proved to be difficult so far as the males are concerned. It was Montgomery (1941) who first brought this problem to the attention of other workers. He pointed out that the two species had been badly confused and that all records hitherto published should be disregarded. Dr. Montgomery and Mrs. Gloyd worked over all the material in the Williamson Collection and their own collections and prepared a key for the separation of the males based upon wholly new characters. The females gave no trouble, since the ovipositor of *L. forcipatus* is decidedly longer than in *L. disjunctus;* but, so great has been the tendency to rely on the characters of the male for determination of species in the Odonata, that, even in the case of paired specimens, misidentifications have been made.

I was much puzzled by this difficulty, since I had never experienced it in Canada, although long familiar with both species as they are found in this country. The old characters used in differentiating them seemed quite satisfactory in the case of the males, as well as the females. My interest in the problem was first aroused in 1949 when, through the kindness of Mrs. Gloyd, I had the opportunity of examining Garman's reared specimens, reported as *L. forcipatus* (1917), but renamed *disjunctus* by Mrs. Gloyd. The males looked like *forcipatus* to me, but the females, apparently of the same species, were like *disjunctus* in the size of the ovipositor but larger than any *disjunctus* I had ever seen.

In the summer of 1950 my wife and I visited Rondeau Park, Kent County, Ontario, on the shore of Lake Erie, and here I found

a number of teneral *Lestes* emerging from a small marshy pond near the lake shore, and they proved to be identical with Garman's specimens, which I had been studying. No males could be found among the tenerals, although I took one mature male of the ordinary *disjunctus* on the beach nearby. Unfortunately we did not have time to search again carefully for males.

The same year I obtained from Dr. Montgomery a fine series of this large *Lestes* from Indiana, and I was so struck by the difference between these specimens, considered as *disjunctus* by Dr. Montgomery, and those from Canada, that I was prepared to believe there was a third species in the group.

In 1951 I visited the Museum of Zoology, Ann Arbor, Michigan, and made a preliminary examination of the material in the Williamson Collection, labelled *L. disjunctus* and *L. forcipatus*. The problem proving unexpectedly difficult, I was permitted to borrow the greater part of the collection of *disjunctus* for further study.* It was not long before I was entirely in agreement with the view of Dr. Montgomery and Mrs. Gloyd that there was but one species in the series they had identified as *L. disjunctus*.

Nevertheless, the great majority of the specimens studied fell into one or the other of two groups and these two groups appeared, in the eastern half of the Continent, to be respectively northern and southern in distribution. In the western half of the Continent, with its varied topography, the problem was more complex.

Dr. Montgomery and Mrs. Gloyd were concerned with the separation of *Lestes disjunctus* and *L. forcipatus*, since the majority of the records referred to the latter were found actually to belong to the former. My main object will be to consider the status of the two groups into which I have divided *L. disjunctus*, but I shall also attempt to contribute something to the problem of separating the males of the two species. The geographic distribution of the various forms will also be recorded.

Since the females of the two species are readily separated by the difference in the relative size of the ovipositor, some difference in the size of the male genitalia, which engage the ovipositor in copulation, would be expected. Examining and measuring these structures carefully I found that segment 2 in *forcipatus* was relatively

* For this privilege I wish to express my sincere thanks to Dr. J. Speed Rogers, Director of the Museum, and Dr. T. H. Hubbell, Curator of Insects.

longer than in *disjunctus*, as compared with the succeeding segments, *e.g.*, segment 3, and that the anterior lamina of *forcipatus* is also somewhat longer and not quite identical in form with that of *disjunctus*. These differences will be considered in detail later.

Combining some of the characters given by Montgomery with others of our own we present the following modified key to the males:

1) Abd. segment 2 three-fifths as long as seg. 3; anterior lamina more than 2.5 mm. long, about 2.5 times as long as abd. sternum 1; white shield-shaped cavity on vesicle of penis widest at front margin; median v-shaped emargination of seg. 10 more than one-third the width of the segment at hind margin; distance from base of proximal tooth of superior appendages to base of distal tooth greater than distance from latter to tip of appendage; distal tooth of sup. appendages never acute
forcipatus

1) Abd. segment 2 half as long as seg. 3; anterior lamina less than 2.5 mm. long, about twice as long as abd. sternum 1; white shield-shaped cavity on vesicle widest behind or at the middle; median v-shaped emargination of seg. 10 one-third or less of the segment width; distance from base of proximal tooth of superior appendages to base of distal tooth equal to, or less than, the distance from base of latter to tip of appendage; distal tooth of sup. appendages variable ..... **disjunctus** 2

2) Generally smaller (abd. usually 26-29 mm., hind wing 18-20); distal tooth of sup. appendages about as sharp and often nearly as large as proximal tooth; pale humeral stripe narrow, not encroaching on the mesepimeron and not confluent with pale latero-ventral area along cross suture, the dark area of the mesinfra-episternum being broadly confluent with that of the mesepisternum ..... subsp. **disjunctus**

Generally larger (abd. usually 31-32, hind wing 21-23); distal tooth of sup. appendages much smaller and blunter than proximal tooth, often rectangular; pale humeral stripe typically encroaching more or less on mesepimeron and confluent with pale latero-ventral area along cross suture, thus isolating a dark spot on mesinfraepisternum
subsp. **australis**

Lestes disjunctus Selys

The division of this species into subspecies is fairly satisfactory in the eastern half of North America. There is some intergradation where the ranges of the two subspecies meet, as would be expected. The situation in the western half of the Continent is more difficult, partly because of the more varied topography and partly because of the lack of sufficient material available for study. This matter will be referred to later. *L. d. disjunctus* is a boreal

form widely distributed across Canada to Alaska and ranging southward in the Cordillera to Colorado and Arizona. *L. d. australis* is widely distributed in the eastern half of the United States, reaching eastern Kansas, Oklahoma and Texas, and possibly farther west, since we have examined a series from Palo Alto, California, that appears to represent a form intermediate between the two subspecies.

Lestes d. disjunctus Selys (Figs. 1 and 5.)

This subspecies is characterized by the relatively small size, darker metallic coloration, more restricted pale areas, heavier pruinosity in adult males and by the sharpness of the distal tooth on the mesal margin of the superior appendages of the male. The female scarcely differs from that of the subspecies *australis* except in the usually smaller size, somewhat darker metallic areas and typically somewhat narrower pale areas.

Measurements (mm.) of 20 ♂ and 20 ♀ from localities across Canada from Nova Scotia to British Columbia are as follows:

	Total length		*Abdomen (excl. apps.)*		*Hind wing*	
♂	33.5–40.5	av. 36.6	25.5–31.0	av. 28.4	17.5–22.3	av. 19.7
♀	32.0–38.0	av. 35.4	25.0–30.5	av. 27.3	20.0–24.5	av. 21.6

Specimens from the coastal region of British Columbia reach a larger size than those from other parts of Canada and the northeastern United States, but smaller specimens occur there also. It is very probable that these larger individuals will be found also along the coast of Washington and Oregon.

The pale markings of the pterothorax in the male are light yellow and clear cut before pruinosity sets in. The humeral stripe is bounded laterally by the humeral suture. In front it does not usually reach the anterior margin of the mesepisternum and it either terminates posteriorly well in advance of the antealar ridge or becomes narrowed to a fine line, usually visible only in tenerals.

Pruinosity begins simultaneously on the rear of the head, the prothorax, the pale latero-ventral regions of the pterothorax and the first two abdominal segments. It spreads over the coxae, dorsum of the pterothorax and slightly over the basal part of the third abdominal segment and on segments 9 and 10. With the onset of pruinosity a dark grayish pigmentation begins to appear over the

metapleural suture and metepimera and spreads forward over the pale parts of the pleura until it sometimes obliterates the entire pale area. This pigmentation and pruinosity appear to be most pronounced at high latitudes and altitudes, where in old males the humeral stripes disappear and the whole thorax becomes dark grayish pruinose.

The two teeth on the mesal margin of the superior appendages of the male are both acute, the distal one usually a little smaller than the proximal, and sometimes considerably so, but always retaining the acute apices.

In the female the pale areas are larger than in the male, the humeral stripe often spreading laterad a little upon the mesepimera and along the cross suture to meet the wider pale area of the ventro-lateral region, the dark area of the mesinfraepisternum being thus isolated, as in both sexes of *L. d. australis*.

The distribution of this subspecies in Canada and Alaska has been given in detail by Walker, Whitehouse, Robert, and Gloyd in their papers listed in the "References," and a general statement is all that is necessary here. It has been reported from Gander, Newfoundland (48° 45′ N.) and ranges from the southern boundaries of all the provinces northward to Goose Bay, Labrador (53° 30′), East Main, James Bay, Quebec (52° 0′); Favourable Lake, Ontario (53° 50′), Gillam, Manitoba (56°), Reindeer Lake, Saskatchewan (56° 23′), Yellowknife, Great Slave Lake, N.W.T. (62° 45′), Dawson, Yukon Territory (64°) and Gulcana, Alaska (62° 10′).

In the United States the distribution of this form, as illustrated by the Williamson Collection, is as follows:

MAINE: Penobscot Co., VII 28 to VIII 20. NEW HAMPSHIRE: Carroll Co., VII 29 to IX 8. MASSACHUSETTS: Lunenburg Co., VIII 19 (1 ♂ somewhat intermediate). MICHIGAN: Allegan, Bay, Charlevoix, Cheyboygan, Chippewa, Emmett, Gogebic, Huron, Iosco, Keewenaw (incl. Isle Royale), Lake, Livingston, Luce, Mackinac, Marquette, Mason, Missaukee, Oakland, Oceana, Osceola, Oscoda, Otsego, Schoolcraft and Washtenaw counties, VI 25 to VIII 23. OHIO: Ottawa and Sandusky counties, VII 10 to VIII 14. INDIANA: Allen, Elkhart, Noble, Steuben and Wells counties, VI 17 to VIII 14. IDAHO: Valley and McCall counties, VI 13. OREGON: Klamath and Baker counties, VII 19 to VIII 13. COLORADO: Boulder Co., VII 23. UTAH: Kane Co., VIII 2. ARIZONA: Kaibab Forest, south of Jacob Lake, VII 31.

The general distribution of the subspecies *disjunctus* may thus be described as follows: Labrador to Hudson Bay, Great Slave

Lake, the Yukon Territory and Alaska, south to Massachusetts, northern Ohio and northern Indiana, west to British Columbia and Oregon and southward along the mountains to Colorado, Utah and Arizona.

The season of flight usually begins in July but occasional individuals emerge in late June or even about the middle of the month. The great majority of specimens examined were taken in July and August.

Lestes d. australis new subspecies (Figs. 2, 3, 6, 8, 10 and 12.)

This is the form that has caused all the confusion between *L. disjunctus* and *forcipatus*. It is usually distinctly larger than *L. d. disjunctus* although there is some overlapping of the two forms in size. Measurements of 20 ♂ s and 20 ♀ s from Virginia, Ohio and Indiana to Florida and Texas are as follows:

	Total length		*Abdomen (excl. apps.)*		*Hind wing*	
♂	37.0–44.0	av. 40.7	28.5–34.5	av. 31.2	20.3–23.5	av. 22.2
♀	38.5–44.0	av. 40.8	29.5–34.0	av. 31.8	22.0–25.5	av. 23.7

The two largest males, each measuring 44 mm. in length, are from Lynn Haven, Fla., and Danby, Mo.; the largest females, measuring 44.0 and 43.5, are from Monticello, Fla., and Bluffton, Ind. The smallest males measure 37 and 38 mm. and come from Lancaster, Ohio, and Jeff Davis Co., Texas, while the smallest females measure 38.0 and 38.5 and are from Knox Co., Ind., and Tift Co., Ga., respectively. On the whole it would appear that the largest individuals are found in Florida and the smallest in Oklahoma and Texas, and that specimens from Indiana and Ohio are but slightly smaller than those from Florida.

As to coloration, the metallic areas tend to be a little duller and the pale markings more extensive than in *d. disjunctus*, those of the thorax usually not so clear but more ochraceous. This is most noticeable in the humeral stripe, which runs the whole length of the mesopleuron. It is narrowed towards the ends but widens in the middle region, usually spreading laterad over the humeral suture. Occasional individuals have these stripes narrow as in *d. disjunctus*. These are sometimes, if not always, intergrades with the latter form. The confluence between the humeral stripe and the ventro-lateral pale area along the cross suture is likewise somewhat variable, but in typical males of *australis* it is present,

while in those of typical *disjunctus* it is either absent or seen only in some tenerals. It is present in the females of both subspecies but tends to be broader in *australis*. No good characters, however, have been found for separating the females, although, in the great majority *australis* is larger and tends to have broader humeral stripes.

Pruinosity in the male follows the same order as in *d. disjunctus* though to a smaller extent. The dorsum of the pterothorax is but slightly involved, the humeral stripes showing in all the specimens I have examined, whereas in *d. disjunctus* they often disappear in old males. The dark pigmentation that appears in the pale latero-ventral areas is present in *australis* as in the northern form, but is much less extensive.

The distal tooth of the superior appendages of the male is smaller in *d. australis* and less acute than in *d. disjunctus*, being generally quite as blunt as in *L. forcipatus*. It seems to be only in the region where the ranges of the two forms meet, that intergrades occur, at least in the eastern half of the continent, although it cannot yet be stated that such a rule is invariable.

Holotype ♂ and allotype ♀ (pair), Bluffton, Wells County, Indiana (Vanemon Swamp), June 6, 1920, E. B. Williamson; in the Museum of Zoology, University of Michigan, Ann Arbor, Mich.

This subspecies belongs to the Austral Region and is almost entirely confined to the United States, where it is widely distributed throughout the eastern half, except northern New England, northern New York, most of Michigan and probably all but the southernmost parts of Wisconsin and Minnesota. It has been found in Canada only at Point Pelee, Essex Co., and Rondeau Park, Kent Co., both in the extreme south of Ontario, on the shore of Lake Erie.

Its geographical and seasonal distribution, as based chiefly on data from the Williamson Collection and material received from Dr. Montgomery, may be summarized as follows:

PENNSYLVANIA: Allegheny and Pittsburgh counties, VI 3. OHIO: Fairfield Co., V 2 to VII 4. INDIANA: Blackford, Cass, Gibson, Huntington, Miami, Randolph, Tippecanoe, Warren and Wells counties, IV 12 to IX 21. IOWA: Black Hawk Co., VI 8. NEBRASKA: Sheridan Co., VII 6. MISSOURI: Jefferson and Shannon counties, VII 8 to IX 18. KANSAS: Leavenworth Co., VI 23. VIRGINIA: Nansemond Co., IX 13, 14. NORTH CAROLINA:

Wake Co. (Raleigh), VI 8. GEORGIA: Houston, Sparks and Tift counties, VI 1 to IX 24. FLORIDA: Alachua, Bay and Pinellas counties, III 8, to XI 21. TENNESSEE: Cumberland (1600'), Davidson and Hardiman counties, V 5 to IX 25. MISSISSIPPI: Harrison Co. (Biloxi), VII 17. LOUISIANA: Terrebonne Co. (Houma), XI 10. TEXAS: Aransas, Jeff Davis and Travis counties, VII 27 to X 6. OKLAHOMA: McClain and Woods counties, IV 20 to VII 4. ONTARIO, CANADA: Essex and Kent counties, VII 7 to 16.

The general distribution of *L. d. australis* is thus the eastern United States, from Pennsylvania, northern Ohio and Indiana, Iowa, Nebraska and Kansas, south to Florida and west to Texas and Oklahoma. It may be safely predicted to occur in New York, southern Michigan and Illinois, and it will probably be found in southern Wisconsin and Minnesota.

A narrow zone, where the ranges of the two subspecies overlap, includes central Pennsylvania, northern Ohio, northern Indiana, extreme southern Ontario, southern Michigan and Iowa. It is probably also found in southern New England and New York State. The available material is not enough to map out this zone definitely but it is roughly indicated by the following observations. Specimens from Pittsburgh, Pa., are either *australis* of rather small size or varying slightly towards *disjunctus* in the more acute distal tooth of the male superior appendages. In Ohio, specimens from the northern counties, Sandusky and Ottawa, are *disjunctus,* while a series of 4 ♂ and 4 ♀ from Lancaster, Fairfield, in central Ohio, are *australis* with a suggestion of *disjunctus* in the narrow humeral stripes of two of the males. Specimens from the northern counties of Indiana: Allen, Elkhart, Noble and Steuben, are *disjunctus,* those from the central and southern counties *australis,* while the considerable series from Wells Co., in the northern third of the State, consists mainly of typical *australis* but includes occasional examples of *disjunctus* and a few intergrades. Specimens from Waterloo, Iowa, are *australis,* varying slightly towards *disjunctus.* Both subspecies have been taken at Point Pelee and Rondeau Park, Ontario, *disjunctus* being much the commoner.

The season of flight of *L. d. australis* is very different from that of *disjunctus.* Throughout its range is appears to be very long with the peak of emergence in early spring. May seems to be the month when the largest number of individuals are on the wing in the north as well as the south. Taking Indiana and Ohio to represent the northern part of the range and Florida the southern part,

the earliest date for the north is April 24, the latest date September 7, both from Bluffton, Indiana, while the earliest date from Florida is March 8 and the latest November 21. Thus, even in the northern part of its range, *australis* begins to emerge about two months earlier than *disjunctus*.

Intermediate forms from California.—Besides the occasional individuals found in the zone of intergradation of the two subspecies, in which the characters are more or less mixed, there is in the Williamson Collection a series of 8 ♂ and 6 ♀ from Palo Alto, California, which apparently represent a definite intermediate population. They were taken in July, 1915, by C. H. Kennedy, but the exact dates are not given. In size they are about average for *australis*, as the following measurements show:

	Total length		*Abdomen (excl. apps.)*		*Hind wing*	
♂	37.5–40.5	av. 39.7	28.5–31.5	av. 30.0	20.0–22.0	av. 21.2
♀	36.5–40.0	av. 37.7	27.0–30.0	av. 28.4	22.5–24.0	av. 22.2

In general appearance these specimens are quite like *australis*, but in all of the males the humeral stripes, though complete, are narrow, barely crossing over the first lateral suture to the epimera. Yet they are connected along the cross suture with the pale area below, and the spot on the mesinfraepisternum is isolated as in typical *australis*. The superior appendages of the males are definitely like *disjunctus*, the distal tooth in every specimen being acute and only a little smaller than the average in *disjunctus*. In the females the abdominal segments, as represented by seg. 3, are a little shorter than in *australis*, but this is a feature that varies in many Odonata with climate, and is of little value in taxonomy. In the absence of any other material from California and most of the adjoining states, it is impossible to offer an opinion on the status of the Palo Alto population.

Lestes forcipatus Rambur (Figs. 4, 7, 9, 11 and 13)

As in *L. disjunctus* the average size of this species decreases northward although there is much variation even within the same local habitat. To illustrate the difference in size between the more northern and more southern specimens, we have measured 10 ♂ and 10 ♀ each from (a) representative northern localities, viz., Nova Scotia, Maine, Quebec, Ontario (north of 43° N.) and northern Michigan, and (b) representative southern localities, viz., Ohio,

Indiana, Illinois, Missouri, Tennessee, southern Michigan (Washtenaw Co.) and southern Ontario (south of 43° N.). The following table gives the range and average of each of the three sets of measurements:

	Northern		*Southern*	
	range	av.	range	av.
Total length ♂	34.5 – 38.0	36.1	37.0 – 43.0	40.2
Total length ♀	32.0 – 38.0	35.5	38.0 – 40.0	39.3
abdomen (–ap) ♂	26.0 – 29.0	27.6	28.0 – 40.0	30.5
abdomen (–ap) ♀	24.0 – 29.0	26.2	28.5 – 31.0	29.8
Hind wing ♂	18.0 – 21.3	19.9	20.4 – 22.0	21.2
Hind wing ♀	21.0 – 24.5	20.1	23.0 – 25.0	23.9

Range of variation in size in a single locality may be illustrated from an envelope in the Williamson Collection containing two males from Bluffton, Ind., put together by Williamson to show this variation. These specimens measured as follows: length 37, 42; abd. 29, 32; h. wing 20.4, 21.5. The smaller specimen is thus only slightly above the average for the more northern localities.

In size and color-pattern *L. forcipatus* closely resembles *L. disjunctus australis*. The pale markings of the thorax are dull ochraceous and become dorsally more or less obscure with age, particularly in the male, in which the humeral stripes are often wholly obliterated. These stripes are considerably widened in the middle region, spreading laterad over the humeral suture upon the mesepimeron, as in *australis,* and connected along the cross suture with the pale area below, thus isolating a dark spot on the mesinfraepisternum. In general there appears to be nothing in the color-pattern to distinguish *L. forcipatus* from *L. d. australis*. Pruinosity becomes heavier northward, as it does in *disjunctus*.

As to structural differences, the females are readily distinguished by the relative length of the ovipositor. In *L. forcipatus* this organ extends beyond the tip of the abdomen, while in *L. disjunctus* it does not quite reach the end. The difference is really greater than this statement implies, since segment 9, whose length is correlated with that of the ovipositor, is a little longer than segment 8, in *L. forcipatus,* whereas in *L. disjunctus* segments 8 and 9 are of about the same length.

The male of *L. forcipatus* is easily separated from that of *L. d. disjunctus* by the difference in the distal tooth of the superior

appendages, which in *forcipatus* is always much shorter than the proximal tooth, usually blunt and sometimes almost obliterated, whereas it is constantly acute in *L. d. disjunctus* and often nearly as large as the proximal tooth. Mature males can also be distinguished in the field, as a general rule, by the difference in the distribution of pruinosity. In *L. d. disjunctus* the prothorax, sides of pterothorax, and bases of legs and wings become bluish white before the thoracic dorsum, which remains dark with the humeral stripes clear and distinct, although eventually, in northern and alpine specimens particularly, the entire thorax may become dark and the pale markings obliterated. In *forcipatus* the entire thorax becomes evenly pruinose and the humeral stripes disappear at an early stage.

The other differences between the two species are found in both subspecies. Montgomery gives the following, which we have incorporated in our key: (1) characters based on the superior appendages of the male, viz., the distance from the base of the proximal tooth to the base of the distal tooth, as compared with the distance from the base of the latter to the tip of the appendage; (2) the width of the V-shaped incision in the posterior margin of segment 10, "if the body has not been crushed or distorted"; and (3) the greatest width of the shield-shaped cavity on the ventral surface of the vesicle. Montgomery gives also a fourth character based on the form of the apical portion of the penis, viz.:

"sides of the apical portion of penis subparallel in ventral view, apical margin straight or concave" ..... **disjunctus**

"apical portion of penis distinctly pear-shaped in ventral view, apical margin convex" ..... **forcipatus**

We examined the penes in a small number of both species, but, finding pear-shaped penes with the apical margin convex in *disjunctus* and triangular penes with the apical margin straight in *forcipatus*, we have not used this character. Montgomery's other characters are all excellent.

The other characters used in our key we have found to be reliable. As compared with the body length, segment 2 is relatively shorter and segment 3 relatively longer in *disjunctus* than in *forcipatus*. The abdomen as a whole is somewhat more slender in *disjunctus*. The anterior lamina is larger in *forcipatus*, the

ridges along the ventro-mesal margin of the posterior expansion of the lamina and separating these parts from the smaller anterior lobes are more strongly sinuate and somewhat more prominent in *forcipatus* than in *disjunctus*. Other slight differences in form can be seen in the figures.

Lestes forcipatus has been recorded from a large part of the United States, but, as already stated, most of these records belong to *L. disjunctus australis*. The known distribution, geographical and seasonal, may be indicated by a summary of the localities and dates of collection of the material in the Williamson Collection:

MAINE: Penobscot Co., VI 18 to VII 29. MASSACHUSETTS: Hampden and Lunenburg counties, VII 23 to VIII 19. MICHIGAN: Bernien, Charlevoix, Chippewa, Huron, Keewenaw, Lake, Mackinac, Midland, Osceola and Washtenaw counties, VI 21 to VIII 31. PENNSYLVANIA: Allegheny Co., V 7. OHIO: Lucas, Portage and Sandusky counties, VI 21 to VII 15. INDIANA: Blackford, Steuben and Wells counties, VI 22 to IX 8. ILLINOIS: Bureau, Cook and DuPage counties, VI 12 to VII 18. TENNESSEE: Nashville and Cumberland counties, V 30 to VII 9. MISSOURI: Shannon Co., VIII 3.

The recorded distribution in Canada is briefly as follows:

NOVA SCOTIA: Annapolis Co., VII 12 to VIII 9. NEW BRUNSWICK: Fredericton; Petitcodiak, VII 9. QUEBEC: Isle d'Orleans, St. Lawrence River; Montreal; Gatineau Valley, n. to Nominingue, Ottawa Co.; La Ferme, Abitibi Co., (48° 50′ N. Lat.), VI 22 to VIII 26. ONTARIO: Counties bordering Lake Erie and Lake Ontario, n. to Smoky Falls, Cochrane District (50° N. Lat.) and Fort Frances, Rainy River District (48° N. Lat.), VI 16 to IX 6. SASKATCHEWAN: Lake Waskesiu, Prince Albert National Park (54° N.), VII 30.

The distributional range of *L. forcipatus* thus centers around the Great Lakes and the St. Lawrence River and from this region it extends northward to the Hudson Bay watershed in Quebec and Ontario, westward to middle Saskatchewan, and southward to Tennessee and Missouri.

As to the season of adult life, it is interesting to note that, where *L. forcipatus* is associated with *L. d. disjunctus*, as in Canada, Maine and Michigan, it matures earlier than *disjunctus* by several weeks, many individuals being mature soon after the middle of June, before *disjunctus* has emerged at all. But in the territory of *L. d. australis*, the latter appears first, being on the wing in

Indiana sometimes in April. It is true that *forcipatus* is recorded from Pennsylvania and Tennessee in May, but there is only one record for each. May 30, the Tennessee date, is not remarkable, but May 7 is probably unusual for Allegheny Co., Pennsylvania. Of the large series from Indiana none was taken before June 22.

As a final problem in the *disjunctus* complex, we may refer to the question raised by Mrs. Gloyd (1938) as to the relationship between this species and the palearctic *L. sponsa*. There appears to be little or no difference between these two species except the much brighter metallic lustre of the Old World form and the narrower, linear humeral stripes. *L. disjunctus* is, in fact, definitely more closely related to *sponsa* than to *forcipatus*. But in all the vast territory inhabited by *L. d. disjunctus* we have seen nothing to approach in brilliancy the thorax of *L. sponsa*, although some northern individuals of *disjunctus*, as noted by Mrs. Gloyd, tend to be a little more metallic than is usual in this species. The relationship of our species to *sponsa* is certainly very close, but we are not prepared at the present time to discuss it further.

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EXPLANATION OF FIGURES

Fig. 1.—*Lestes disjunctus disjunctus* ♂, lateral view of thorax. X 8.
Fig. 2.—*L. disjunctus australis* ♂, lateral view of thorax. X 8.
Fig. 3.—*L. disjunctus australis* ♀, terminal segments and ovipositor. X 8.
Fig. 4.—*L. forcipatus* ♀, terminal segments and ovipositor. X 8.
Fig. 5.—*L. d. disjunctus* ♂, anal appendages, dorsal view. X 26.
Fig. 6.—*L. d. australis* ♂, anal appendages, dorsal view. X 26.
Fig. 7.—*L. forcipatus* ♂, anal appendages, dorsal view. X 26.
Fig. 8.—*L. d. australis* ♂, lateral view of segments 1, 2 and 3 of abdomen, to show form and relative length of parts. X 8.
Fig. 9.—*L. forcipatus* ♂, lateral view of segments 1, 2 and 3 of abdomen, for comparison with fig. 8. X 8.
Fig. 10.—*L. d. australis* ♂, ventral view of abdominal segments 1, 2 and base of 3, showing proportion of parts and form of white shield-shaped cavity on vesicle of penis near posterior end of seg. 2. X 17.5.
Fig. 11.—*L. forcipatus* ♂, same parts as in fig. 10 and on same scale.
Fig. 12.—*L. d. australis* ♂, anterior lamina, right lateral view. X 30.
Fig. 13.—*L. forcipatus* ♂, anterior lamina on same scale as fig. 12, to show difference in size and form.

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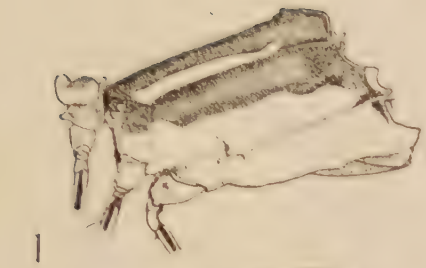
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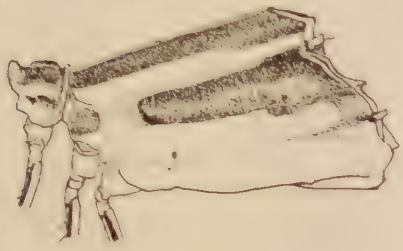
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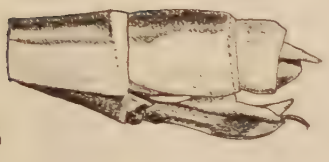
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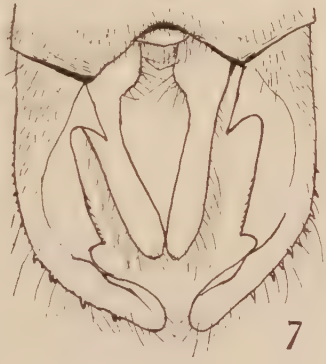
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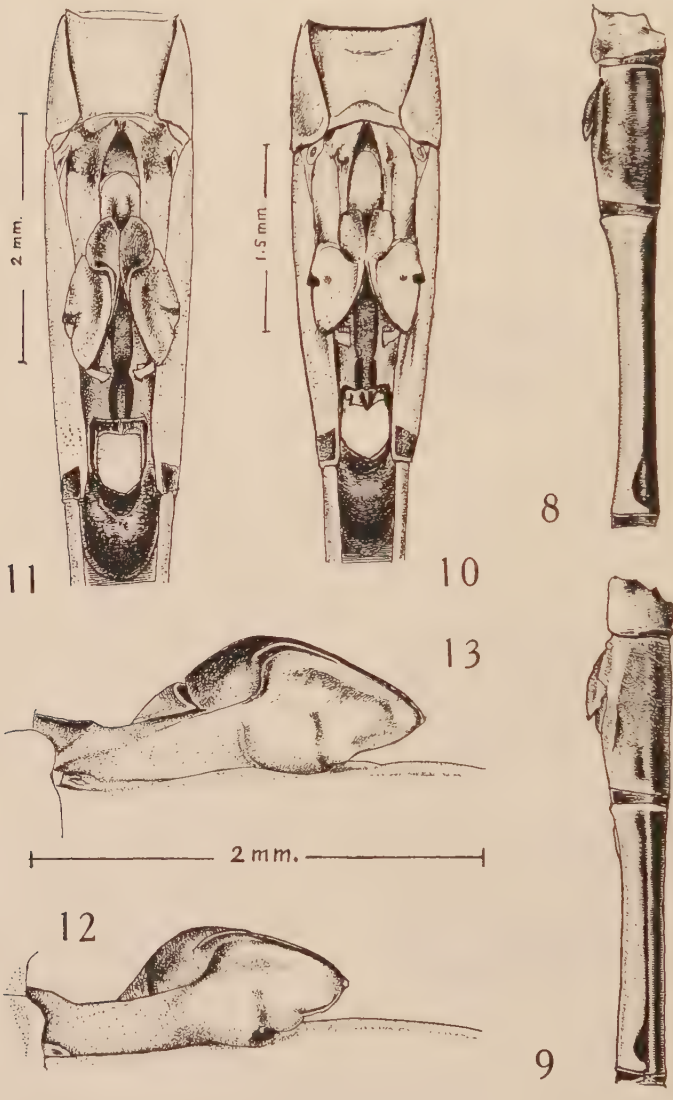
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THE DISTRIBUTION AND SUBSPECIATION OF EREBIA ROSSII Curtis (LEPIDOPTERA: SATYRIDAE)

BY PAUL R. EHRLICH

Collaborator, Northern Insect Survey [1]

Introduction

Erebia rossii has long been considered one of the rarest of all holarctic butterflies. Before 1930 most museum collections contained only a few specimens, if any, and it was practically unknown to private collectors. Between 1930 and 1947 considerable material was collected at Churchill, Manitoba, and Mt. McKinley National Park, Alaska; however, typical material from the heart of the Canadian Arctic remained almost unknown. Since 1947 extensive collecting in northern Canada by the Northern Insect Survey has produced sufficient material [2] to give a fairly clear picture of *rossii* in North America. Unfortunately the Asiatic race of *rossii* is still relatively unknown, the treatment used by the present author being based on information supplied by Mr. B. C. S. Warren, either in his "Monograph of the genus Erebia" or *in litt.*

Historical Background.—Since the description of *rossii* by Curtis in 1835 there have been four important works mentioning the distribution and characters of the subspecies.

Elwes, dealing briefly with the species in his "Revision of the genus Erebia" (1898), places *ero* Brem. as a synonym of *rossii*. Interestingly, according to him, Strecker had Hudson Bay *rossii* (*ornata* Leuss.) confused with *E. fasciata* Butler.

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[1] The Northern Insect Survey is a joint project of the Defense Research Board, Dept. of National Defense, and the Division of Entomology of the Dept. of Agriculture, Canada.

[2] The vast majority of this material is in the Canadian National Collection.

Warren's "Monograph of the genus Erebia" (1936) deals in detail with the names proposed to the time of its completion. Unfortunately, due probably to a lack of material, Warren draws erroneous conclusions concerning the status of *kuskoquima* Holland and the distribution of "*erda*" Shelj. These will be discussed in detail under the subspecies themselves.

In "Critical notes on the Canadian species of the genus Erebia (Lepid.)", McDunnough (1937) corrects Warren's misconceptions and adds some notes on distribution.

Finally C. F. dos Passos in his "New butterflies from Mount McKinley National Park, Alaska, with a review of *Erebia rossii* (Rhopalocera, Satyridae)" gives a brief summary of the Nearctic races in conjunction with his description of *rossii gabrieli*. The work is notable for its fine synonymies.

Materials and Methods.—The present author has personally examined and measured 421 male and 93 female specimens of the Nearctic races in the Canadian National Collection, the American Museum of Natural History, the Academy of Natural Sciences of Philadelphia, the collection of Mr. Otto Buchholz of Roselle Park, N. J., the collection of Dr. George W. Rawson of Summit, N. J., and the author's personal collection. Mr. Harry K. Clench of the Carnegie Museum kindly measured an additional 22 males and 11 females in that institution. Topotypical material of all North American races has been examined, including the holotype and allotype of *gabrieli* and paratypes of *ornata*. All measurements are length of one primary wing, base of subcosta to apex (l.p.w.) in millimeters, taken to the nearest millimeter. In the descriptions "spots" refer to disks of color, "ocelli" refer to disks of color pupilled with a different color, the pupils with or without white centers.

The approximate longitude and latitude of specific localities are given wherever possible.

Acknowledgments.—The author wishes to thank Mr. B. C. S. Warren, of Folkestone, Kent, England, for his help in solving several taxonomic problems, and for the information which he supplied on the Asiatic race of *rossii,* which made possible the inclusion of this race in the present work.

The author is most grateful to Mr. Harry K. Clench of the Carnegie Museum, who, at his request, measured part of the series of *kuskoquima* in that institution, as well as several other specimens from little-known localities. Thanks also go to Dr. F. H. Rindge, Curator of Lepidoptera of the American Museum of Natural History, and Dr. A. B. Klots, Research Associate of the same institution, for advice on several points and for reading this manuscript.

A special word of thanks is given to Dr. T. N. Freeman of the Canadian Dept. of Agriculture, Co-ordinator of the Northern Insect Survey, for favors too numerous to mention. Without his aid this paper would never have been possible.

Systematic Descriptions

Erebia rossii (Curtis)

Hipparchia Rossii Curtis 1835, in Ross, Narrative of a second voyage in search of a north-west passage, app., p. lxvii, pl. A, fig. 7.

Facies.—These are discussed fully under each subspecies.

Male Genitalia.—The following 11 specimens were examined and have been dissected by the author: Cape Mugford, Labrador, August, 1930, S. C. Palmer; Frobisher Bay, Baffin Island, N.W.T., July 7, 1948, F. G. DiLabio; Repulse Bay, N.W.T., July 12, 1950, Paul F. Bruggemann; Le Pas, Manitoba, June 3, 1932, coll. Harper; Churchill, Manitoba, July 16, 1942, coll. Brooks; Baker Lake, N.W.T., September 7, 1950, coll. Gottschalk; Caribou Pass, Upper Peace River District, Northern British Columbia, alt. 5200′, July 26, 1932, J. de N. Henry; McKinley, Alaska, June 20-July 9, 1930; Mt. McKinley Park, Alaska, July 18, 1932; Bethel, Alaska, June 3; Bethel, Alaska, June 3, 1937.

Although the genitalia vary somewhat from specimen to specimen, especially in the shape and spines of the clasp, no evidence of subspecific variation was seen. This confirms the findings of dos Passos (1949, p. 16). Plate 32, figs. 308-313 and plate 33, figs. 314, 315 and 317 of Warren (1936) are photographs of the male genitalia.

Female Genitalia.—The following four specimens in the author's collection have been dissected: Baker Lake, N.W.T., July 26, 1947, T. N. Freeman; Churchill, Manitoba, July 6, 1933; McKinley Park, Alaska, June 20-July 9, 1930; Bethel, Alaska, June 2.

A brief description of the female genitalia follows:

Bursa copulatrix membranous, approx. 1.75 mm. in length, 1 mm. in width at its widest, bluntly oval in outline, tapering slightly towards the ductus bursae. Bursa with two simple signa, approx. 1 mm. by .15 mm., covered with numerous small spines and lying more or less parallel to the axis of the ductus bursae. The latter membranous, approx. .9 mm. by .3 mm., slightly narrower at anterior end; ostium a transverse rectangle. Posterior edge of genital plate projecting ventrally in a broadly "U"-shaped curve, the center of which is produced posteriorly, giving the whole structure a scoop-like appearance. Posteriorly projecting tongue of the scoop stippled, flaring medially, bluntly bilobate distally. Ovipositor lobes lunate, lightly sclerotized; apophyses of ovipositor approx. .4 mm. long, tapering to a point anteriorly.

No indication has been seen of subspecific variation in the female genitalia, which are very constant in comparison with the male organs.

Early Stages.—Unknown.

Habits.—Freeman (1948, p. 64) discusses these. The insects fly in low damp spots (*Carex* meadows), and have a short flight period. Suitable habitats are somewhat broken up, and this, combined with the short flight, probably results in little dispersal.

Remarks.—The only other species of *Erebia* with which *rossii* can be confused is *disa* Thunberg. In the vast majority of cases the latter may be distinguished by the chain of four more or less equal-sized ocelli on the primaries. Two out of thirty-six male *disa* in the author's collection have only two ocelli on the primaries, one of them having one and the other two additional spots. Such specimens can cause confusion (Cadbury, 1938), and it is best to identify them by referring to the genitalia. The males are readily separated by the gnathos, which in *rossii* is pointed, and in *disa* is spatulate. Females are also easily determined by examination of the genitalia. In *rossii* the tongue of the scoop is stippled and bluntly bilobate distally; in *disa* it is unstippled and sharply bilobate distally, the cleft between the lobes being approx. .6 mm. deep.

Key to the Subspecies of Erebia rossii

The following key will determine the majority of specimens of *rossii*. It is designed for both sexes, but will work better for males, which are more constant in their characters.

A. Forewing with two fused subapical ocelli ..... B
B. Banding on underside of secondaries not strongly contrasting but well defined, basal area completely concolorous with extradiscal band or darker only near inner margin; subapical ocelli usually well fused into one large ocellus ..... *ornata*
BB. Banding on underside of secondaries partially obscured, basal half of the wing usually completely dark; ocelli often only slightly fused ... *cro*
AA. The two subapical ocelli on forewing distinct, or forewing immaculate C
C. Basal area and extradiscal band on underside of secondaries very light, dark median band most prominent ..... *kuskoquima*
CC. Underside of secondaries otherwise ..... D
D. Primaries usually with spots or ocelli in addition to subapical pair, additional spots and or ocelli large; secondaries often with three or more large spots or ocelli; spots and rings of ocelli usually yellowish. *cro*
DD. Additional spots and/or ocelli on both wings, if present, small; rarely with large spots or ocelli on secondaries; spots and rings of ocelli orange ..... E
E. Underside of secondaries completely dark, banding very indistinct; upperside chocolate brown, often immaculate, subapical ocelli when present small, additional spots or ocelli rare ..... *rossii*
EE. Extradiscal band lighter, most prominent; upperside medium to dark brown, rarely immaculate; subapical ocelli, when present, usually large; additional spots or ocelli common on primaries, less common on secondaries, in males especially ..... *gabrieli*

Erebia rossii rossii (Curtis)

Hipparchia Rossii Curtis, 1835, in Ross, Narrative of a second voyage in search of a north-west passage, app., p. 67, pl. A, fig. 7.

Erebia disa ?var. vel. bona sp. *rossi* [*sic*] Elwes, 1889, Trans. Ent. Soc. London, p. 330.

Male: l.p.w. 20-24 mm., average (198 spm.) 22.2 mm.

Above, primaries and secondaries light to deep chocolate brown. Primaries usually immaculate or with two subapical ocelli, rarely with as many as five ocelli and/or spots. Subapical ocelli very rarely partly fused, larger than any additional submarginal spots or ocelli. Spots and rings of ocelli orange, pupils very dark brown. Secondaries usually immaculate, rarely with one to four orange spots and/or orange ringed ocelli. Pupils of ocelli, when present, very small.

Below, primaries, marginal band brown, brown extending basally along the costa and inner margin, basal and median discal areas dark orange brown. A brown line indicating the outer edge of a median band may be seen in some specimens. Apex flecked with gray scales. Ocelli and spots reappearing, sometimes with a small white center. Secondaries, contrastingly

darker than primaries, basal area dark gray brown along costal margin, dark brown along inner margin. Median band dark brown, irregular, crenate distally, and sparsely flecked with gray scales. Extradiscal band dark gray brown; marginal band dark brown, crenate basally, heavily flecked with gray scales distally. Spots or ocelli on upper surface of secondaries often indicated by white dots on underside.

Fringes tan, checked with brown at veins; antennae yellowish, annulated with brown; head, thorax, and abdomen very dark brown.

FEMALE: l.p.w. 20-24 mm., average (53 spm.) 22.1 mm.

Above, primaries brown, occasionally with an orange suffusion; secondaries brown. Primaries very rarely immaculate, usually with two subapical ocelli or spots. Other variations of maculation as in male.

Below, lighter than male, often with very little contrast between primaries and secondaries. Some specimens with especially light secondaries have median band outlined in brown with a gray brown center, and marginal band outlined basally in brown, the distal portion being gray brown. Otherwise similar to male.

Remarks.—Illustrations of this race may be found in Holland (1931), pl. 73, figs. 3, 4; Holland and Avinoff (1935), pl. 35, figs. 16-18; and Warren (1936), pl. 73, figs. 925, 928, 931, 934.

This is the smallest, darkest, least ornate of the races of *rossii.* Warren (1936, p. 162) confuses some specimens of this race with *kuskoquima,* in the mistaken belief that *kuskoquima* was only a two spotted "form" of *Erebia rossii erda* Shelj., a name which the present author feels is synonymous with *ero* Brem.

Distribution.—This race is known from northern Labrador, southern Baffin Island, Southampton Island, Melville Peninsula, and Boothia Peninsula (the type locality). It extends southward in the District of Keewatin where it grades clinally into *ornata.* An artificial dividing line would be about 62°30′ N. It occurs westward along the northern fringe of the continent, theoretically extending inland as far as the tree line, to the Mackenzie Delta, where it blends imperceptibly into *gabrieli.* It has been taken on southern Victoria Island and probably extends somewhat further north in the Arctic Archipelago, although the author doubts if it will be found further than 74° N. An annotated list of specific locality records follows:

Cape Mugford, Labrador, 57°50′ N., 62°45′ W. A single battered male, l.p.w. 24 mm. This is the specimen recorded as "*Eresia rossi* Curtis" by Williams (1931). It is the most eastern record we have of *rossii.*

Frobisher Bay, Baffin Island, 63°25′ N., 67°50′ W. 47 males, 15 females, average l.p.w., males 22.6, females 22.4. Specimens very dark, many immaculate, banding usually very obscure.

Lake Harbour, Baffin Island, 62°50′ N., 69°55′ W. 6 males, 2 females, average l.p.w., males 23.3, females 23.0. Bands not quite as obscure as in Frobisher Bay specimens, otherwise quite similar.

Amadjuak Lake, Baffin Island, 65°00′ N., 71°30′ W. 3 males, average l.p.w. 22.3. Very similar to Frobisher Bay specimens.

Netilling Lake, Baffin Island, 66°30′ N., 71°00 W. 5 males, 2 females, average l.p.w., males 22.4, females 22.5. Similar to Lake Harbour specimens.

Coral Harbour, Southampton Island, 64°10′ N., 82°50′ W. 6 males, 1 female, average l.p.w. males, 22.0, l.p.w. female 20. Banding obscure, ocelli and spots greatly reduced, 3 males with only traces of subapical spots.

Ross Bay, Melville Peninsula, 66°51′, 84°53′ W. 1 male, l.p.w. 22, 1 female, l.p.w. 22. Immaculate, banding obscure.

Repulse Bay, N.W.T., 66°40′ N., 86°15′ W. 31 males, 6 females, average l.p.w., males 22.1, females 21.5. Males dark basally, banding very obscure; 15 males immaculate.

Spence Bay, Boothia Peninsula, 69°20′ N., 90°00′ W. (type locality). 1 male, l.p.w. 23, 1 very small subapical spot on upperside of primaries, 2 traces on underside; banding obscure, especially basally. 1 male, l.p.w. 22, 2 traces of subapical spots on upperside of primaries; banding obscure, especially basally. 1 female, l.p.w. 23 mm., 2 subapical ocelli and 1 small spot on upper and underside of primaries; three spots on upperside of secondaries; banding fairly obscure.

Lady Melville Lake, Boothia Peninsula, 69°25′ N., 93°15′ W. (near type locality). 1 male, l.p.w. 22, trace of subapical spot on upperside of primaries, 2 small ocelli on underside; banding obscure, especially basally.

Hanbury Lake to Hanbury River, Portage Grove Falls, N.W.T., 63°50′ N., 106°00′ W. 4 males, 1 female, average l.p.w. males 23, l.p.w. female 22. Transitional towards *ornata*, two males typical, two with additional ocelli.

Baker Lake, N.W.T., 64°20′ N., 96°00′ W. 17 males, 8 females, average l.p.w., males 21.6, females 21.6. Transitional towards *ornata*, ocelli sometimes coalesced, all but three specimens with evidence of spot in addition to subapical ocelli on upperside of primaries. Banding varying but fairly obscure.

Chesterfield Inlet, N.W.T., 63°40′ N., 90°50′ W. 13 males, 8 females, average l.p.w., males 22.0, females 22.1. Similar to Baker Lake specimens.

Cambridge Bay, Victoria Island, 69°00′ N., 104°45′ W. 1 male, l.p.w. 21 mm. Banding fairly obscure.

Wollaston Peninsula, Victoria Island, 69°30′ N., 115°00′ W. 1 male, l.p.w. 22. Banding fairly clear.

Bathurst Inlet, N.W.T., 67°10′ N., 108°10′ W. 20 males, average l.p.w. 21.5. Banding variable, usually obscure.

Coppermine, N.W.T., 67°45′ N., 115°15′ W. 13 males, 3 females, average l.p.w., males 22.0, females 22.3. Banding obscure to as in *gabricli*.

Mackenzie Delta (Reindeer Depot, Kendall Island, Richardson's Island and Loon Channel), N.W.T., 68°30′ N., 135°00′ W. 26 males, 5 females, average l.p.w., males 22.2, females 21.8. 17 males, 3 females examined by the author. Banding as in *gabrieli* but fewer and smaller ocelli above.

Erebia rossii ornata Leussler

Erebia rossii Elwes (*partim*), 1898, Trans., Ent. Soc. London, p. 202.

Erebia rossii Curtis race *ornata* Leussler, 1935, Bull. Brooklyn Ent. Soc., vol. 30, p. 50.

MALE: l.p.w. 20-25 mm., average (179 spm.) 22.5 mm.

Above, primaries and secondaries brown. Primaries with two subapical ocelli almost always fused into one large ocellus, and one to three additional submarginal spots and/or ocelli. Secondaries with one to four spots and/or ocelli.

Below, primaries with dark orange brown area brighter and more extensive than in *rossii*, sometimes reaching the outer margin medially. Ocelli of primaries usually reappearing, quite often with white centers. Secondaries lighter on the average than in *rossii*. Other characters as in *rossii*.

FEMALE: l.p.w. 20-24 mm., average (29 spm.) 22.0 mm.

Above, primaries and secondaries light brown. Primaries with two subapical ocelli fused into one large ocellus and two to three additional submarginal spots and/or ocelli. Secondaries with one to four spots and/or ocelli.

Below, as in male only slightly lighter. Other characters as in *rossii*.

Remarks.—Illustrations of this race are figs. 13-16 of dos Passos (1949). This is the most brilliantly marked of the Nearctic races, and is the only race with the subapical ocelli consistently fused.

Warren (1936, p. 162) confused some specimens of this race with *erda* Shelj. (= *ero* Brem.).

Distribution.—This race occurs in southern Keewatin District, where it forms a cline with *rossii,* and northwestern and west central Manitoba. Its presence south of the tree line indicates islands of arctic conditions within the boreal forest and northern transition. An annotated list of specific locality records follows:

Le Pas, Manitoba, 53°50′ N., 101°15′ W., 2 males, l.p.w. 22, 23. Typical specimens. This is the most southerly record of *rossii* in North America.

Gillam, Manitoba, 56°30′ N., 94°45′ W. 1 male, l.p.w. 22. Typical specimen.

Churchill, Manitoba, 58°30′ N., 94°15′ W. (type locality). 126 males, 16 females, average l.p.w., males 22.8, females 22.3. Typical specimens.

Eskimo Point, N.W.T., 61°15′ N., 94°20′ W. 35 males, 6 females, average l.p.w., males 21.3, females 21.3. Very close to typical *ornata*, but showing tendencies towards *rossii*.

Padlei, N.W.T., 62°00′ N., 96°40′ W. 10 males, 7 females, average l.p.w., males 22.1, females 22.0. Similar to Eskimo Point specimens.

Erebia rossii gabrieli Dos Passos

Erebia rossii Warren, 1936 (*partim*), Monograph of the genus *Erebia*, p. 162.

Erebia disa mancinus Cadbury (*nec* Westwood), 1938, Proc. Acad. Nat. Sci. Phila., vol. 84, p. 397, pl. 16, fig. 13.

Erebia rossii gabrieli dos Passos, 1949, Amer. Mus. Novitates, no. 1389, p. 12, figs. 17-28.

MALE: l.p.w. 21-24 mm., average (53 spm.) 23.2 mm.

Above, primaries and secondaries light to chocolate brown. The primaries seldom without ocelli; usually with two fairly large subapical ocelli and often with one to two submarginal orange spots.

Below, somewhat lighter than *rossii*, secondaries with the gray brown extradiscal band more prominent and flecked with brown scales, giving a somewhat striated appearance. Other characters as in *rossii*.

FEMALE: l.p.w. 22-24 mm., average (8 spm.) 23.2 mm.

Above, primaries and secondaries light brown. The primaries with two subapical ocelli; some specimens with one or two additional submarginal spots or (rarely) ocelli. Secondaries with none to occasionally four small submarginal spots and/or ocelli.

Below, somewhat lighter than the males, but otherwise the same. Other characters as in *rossii*.

Remarks.—The race is well illustrated in the original description. This is the weakest race of *rossii* recognized in this paper, and is thus the hardest to characterize. In March of 1951 Mr. B. C. S. Warren wrote the author "I . . . am wondering if dos Passos' McKinley *E. rossii gabrieli* is as distinct from typical *rossii rossii* as I thought."[3] It is the author's opinion that *gabrieli* is merely a transition between *rossii* and *kuskoquima*, however, no truly intermediate populations between *gabrieli* and *kuskoquima* have been seen. Pending the possible discovery of such populations it has been considered best to retain the name, on the chance that it actually represents the termination rather than the middle of a cline.

Warren (1936, p. 162) lists a Kluane, Yukon specimen of this race as a form of *erda* Shelj (= *ero* Brem.).

Distribution.—*Gabrieli* has been seen from the Brooks Range of Alaska, the western coast of Alaska as far south as St. Michael,

[3] See dos Passos (1949, p. 15).

the Alaska Range, and the mountains of the southern Yukon and northern British Columbia. The author would not be too surprised to see an isolated population of *gabrieli* discovered on an out-of-the-way mountain top in the northern Rocky Mountains of the United States. An annotated list of specific localities follows:

Caribou Pass, Upper Peace River District, British Columbia, 57°00′ N., 123°40′ W. 1 damaged male, l.p.w. 24 mm. This is the specimen described and figured by Cadbury (1938) as *Erebia disa mancinus* Hewitson. It has been genitalically determined as *rossii* by the present author.

Muncho Lake, British Columbia, 58°50′ N., 125°40′ W. 2 males, l.p.w. 23, 24. 1 with two ocelli, the other nearly immaculate; banding obscure in both.

Kluane, Yukon Territory, 61°00′ N., 138°30′ W. 1 male, l.p.w. 22. Banding fairly clear.

Mts. (between?) 40 mile and Mission Creeks, Alaska, 64°00′ N., 143°00′ W. 1 male, l.p.w. 22. Specimen not examined.

Alfred Creek Camp, Alaska (locality unlocated). 2 males, l.p.w. 23, 24. Bands as in typical *gabrieli*; one immaculate, one with two subapical ocelli.

Mt. McKinley National Park, Alaska, 63°30′ N., 149°00′ W. (type locality). 34 males, 7 females, average l.p.w., males 23.2, females 23.0. A long series from this locality is analyzed in the original description.

Anaktuvuk Pass, Alaska, 68°20′ N., 151°30′ W. 1 male, l.p.w. 23.

Nelson Point, Kotzebue, Alaska, 67°10′ N., 162°30′ W. 1 male, l.p.w. 23. Specimen a deep chocolate brown on upperside with two good sized subapical ocelli. Underside typical *gabrieli*.

Nome, Alaska, 64°30′ N., 165°30′ W. 6 males, 1 female, average l.p.w. males 23.3, l.p.w. female 24. 5 males typical *gabrieli*, 1 male and the female approaching *kuskoquima*. This is the only population that showed any real indication of being transitional to *kuskoquima*, however, since *kuskoquima*-like specimens occur once in a great while in populations of *rossii rossii* and *ornata* no great importance can be attached at present to the transitional specimens.

St. Michael, Alaska, 63°30′ N., 162°05′ W. 4 males, average l.p.w. 23.3. Only one male examined by the author, it has an extremely narrow extradiscal band, but is otherwise typical *gabrieli*.

Erebia rossii kuskoquima Holland

Erebia rossii Skinner, 1899, Ent. News, vol. 10, p. 113.

Erebia rossi [*sic*] (Curtis) Var. *kuskoquima* Holland, 1931, The butterfly book, revised ed., p. 203, pl. 61, figs. 21-23.

E[*rebia*] *rossii* ssp. *erda* f. *kuskoquima* Warren (*nec* Holland), 1936, Monograph of the genus Erebia, p. 161.

MALE: l.p.w. 22-24 mm., average (18 spm.) 23.4 mm.

Above, primaries and secondaries brown, maculation much as in *gabrieli*.

Below, primaries as in *gabrieli*. Secondaries contrastingly light, almost entirely gray brown; median band outlined in brown, becoming gray brown in center; marginal band outlined basally in brown, becoming gray brown distally; basal area mostly gray brown, setting off median band which is very prominent in this subspecies. Gray brown areas of secondaries flecked with brown scales giving a striated appearance. Other characters as in *gabrieli*.

FEMALE: l.p.w. 22-25 mm., average (14 spm.) 23.0 mm.

Above, as in *gabrieli* except spots and ocelli tend to be more numerous on both primaries and secondaries.

Below, as in male.

Remarks.—Figure 21 accompanying the original description is the male lectotype (designated by dos Passos, 1949, p. 12). Figures 22 and 23 are females. Warren's figures of "*kuskoquima*" should be referred to *ero*.

Warren, in attempting to identify this race by the ocelli, caused considerable confusion. This is thoroughly discussed by McDunnough (1937, p. 14, 15), who correctly identifies *kuskoquima* by the character of the underside of the secondaries.

Distribution.—This race is known to the author only from the type locality, the lower Kuskokwim Valley, Alaska (60°40′ N., 162°30′ W.); most specimens probably being taken around Bethel, from which locality many are labeled.

Mr. Wm. D. Field of the U. S. National Museum has written the author that there is a specimen of *kuskoquima* in that institution from Nushagak, Alaska (59°00′ N., 158°30′ W.).

Erebia rossii ero Bremer

Erebia ero Bremer, 1861, Bull. Acad. imp. Sci. St. Petersb. 3:468.

Erebia rossii ero forma *polyopis* Sheljuzhko, 1918, N. Betir. syst. Insektenk. 1:104.

Erebia erda Sheljuzhkko, 1924, Ent. Anz. 4:165.

Erebia dzhelindae Sheljuzhko, 1925, *ibid.*, 5:1.

Erebia dzhelindae f. *polyopis* Sheljuzhko, *ibid.*, 5:2.

Erebia rossii ab. *nigra* Goltz, 1930, *in* Seitz, Grosschmett. Erde Supp. 1:150.

Erebia rossii ero ab. *grina*, nom. nov. This name is proposed to replace *Erebia rossii* ab. *nigra* Goltz, which is a homonym of *Erebia aethiops* ab. *nigra* Mousley, 1902, Ent. Rec. 14:19. The type of *Erebia rossii ero* ab. *grina* Ehrlich is the type of *Erebia rossii* ab. *nigra* Goltz.

Erebia rossii ab. *pallida* Goltz, 1930, in Seitz, Grossschmett. Erde Supp. 1:150.

Erebia rossii ero ab. *goltzi*, nom. nov. This name is proposed to replace *Erebia rossii* ab. *pallida* Goltz, which is a homonym of *Erebia aethiops* ab. *pallida* Mousley, 1902, Ent. Rec. 14:19. The type of *Erebia rossii ero* ab. *goltzi* Ehrlich is the type of *Erebia rossii* ab. *pallida* Goltz.

E[rebia] rossii erda, Warren, 1936, Monograph of the genus Erebia, p. 160.

E[rebia] rossii ssp. *erda* f. *kuskoquima*, Warren, *ibid.*, p. 161.

E[rebia] rossii ssp. *erda* ab. *polyopis*, Warren, *ibid.*, p. 162.

E[rebia] rossii ero, Warren, *ibid.*, p. 163.

E[rebia] rossii ssp. *ero* ab. *dzhelindae*, Warren, *loc. cit.*

E[rebia] rossii ssp. *ero* ab. *nigra*, Warren, *ibid.*, p. 164.

E[rebia] rossii ssp. *ero* ab. *pallida*, Warren, *loc. cit.*

MALE: l.p.w. 22-26 mm., average (11 spm.) 23.7 mm.
FEMALE: l.p.w. 21-24 mm., average (5 spm.) 23.0 mm.

Because no specimens are available for examination, a detailed description of this race is not feasible. *E. r. ero* appears to occur in two forms, one very large and ornate (*erda* Shelj.), and one smaller and less ornate (*ero* Brem.). The latter may be an altitude form or a recurrent aberration. On the underside *ero* is characterized by the contrasting darkness of the basal half of the secondaries, which may completely obliterate the median band. The race is very variable, and several aberrations have been named. *Erebia rossii ero* ab. *polyopis* Shelj. is an aberration in which the spots and ocelli on the upperside are enlarged, the two subapical ocelli being fused. It was described from the Dzhelinda River, Dzhugdzhur Mts. *Erebia rossii ero* ab. *dzhelindae* Shelj. was also described from the Dzhugdzhur Mts., and is very close to *polyopis*. *Erebia rossii ero* ab. *grina* Ehrl. is based on a specimen from the Sayan Mts. which is immaculate on the upper surface. Ab. *goltzi* Ehrl. is based on a female from the Sayan Mts. with a gray ground color.

Remarks.—Attention is called to the two *nomina nova* in the bibliography above.

Figures in Warren which should be referred to *ero* are pl. 73, figs. 926, 927, 932, 933, and pl. 74, figs. 935-958.

Erebia erda Shelj., previously considered a distinct race of *rossii*, has been placed as a synonym of *ero* Brem. in this paper for the

following reasons: 1) as far as can be determined both forms occur sympatrically, 2) individual specimens often cannot be placed in one form or another (Warren *in litt.* states "I am a little doubtful whether ab. *dzhelindae* is really an ab. of *erda* or *ero!*"), and all intergrades between the two forms seem to occur, 3) variation in the banding on the underside of the secondaries, which in the Nearctic races has proved the most reliable character, shows no more variation than is found in *rossii rossii*.

Our knowledge of Asiatic *rossii* is very meager. The finest collection, that of Herr Sheljuzhko, is now in Russian hands, and no new material is reaching the West. Distribution and subspeciation can be very complex in the mountains of Asia (see Avinoff and Sweadner, 1951), and it is possible that *erda* and *ero* are geographic subspecies with a very complex distribution; however, until more material and information can be obtained, the author feels that the present arrangement is best.

Distribution.—Ero is recorded from Kara Tundra, Altai Mts., West and East Sayan Mts., Baikal Mts., Transbaikalia east to the Amur, Dzhugdzhur Mts., and St. Lawrence Bay, all in Asia.

The following notes on these localities may be of help to future workers:

Kara Tundra: presumably near where the Kara River empties into Baidaratskaya Guba, an arm of the Kara Sea. Approx. 69° N., 65° E.

Altai Mts.: roughly running along the southwest border of the Mongolian Republic.

West and East Sayan (Sajan) Mts.: running southeast from near Stalinsk through Tanna Tuva to Irkutsk.

Munko-Sardyk (type locality of *erda*): presumably refers to Mt. Munko Sardik, the highest peak (11,453′) in the Sayan Mts., located on the boundary between the Buryat-Mongol A.S.S.R. and Outer Mongolia at the north end of Koso Gol (Khubsugul Dalai), some 160 miles west south-west of Irkutsk.

Baikal Mts.: running northeast of Irkutsk along Lake Baikal.

Transbaikalia: area roughly from Irkutsk east to the Sea of Okhotsk.

Apfelgebirge (type locality of *ero*): according to Sheljuzhko (*in litt.*) this is an incorrect German translation of Jablonovyj (Yablonoi) Mts. These lie about 400 miles east of Lake Baikal, and roughly parallel to it.

Dzhugdzhur Mts.: lying along the Sea of Okhotsk between 55° and 60° N.

St. Lawrence Bay: somewhere on the Asiatic Bering Sea coast.

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PRELIMINARY ANNOTATED LIST OF THE WASPS OF WESTMORELAND STATE PARK, VIRGINIA, WITH NOTES ON THE GENUS THAUMATODRYINUS (HYMENOPTERA: ACULEATA)

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The following preliminary list of the wasps of Westmoreland State Park, Virginia, enumerates the species captured during a week's stay from July 2 to 8, 1951. The total number of specimens collected and inclusive dates of capture are noted for each species, together with any pertinent notes on habitat preferences, prey records or nesting habits. A description is included of the hitherto unknown male of *Crossocerus* (*Euchiha*) *xanthochilos* Pate. An appendix has been added to make available some notes on the dryinid genus, *Thaumatodryinus* Perkins, and to describe a new species.

The park is located in Westmoreland County along the south bank of the lower Potomac River some 35 miles east of Fredericksburg. It comprises about 1,300 acres at elevations ranging from sea level to 150 feet. Most of the area is covered with dense to open woods with the vegetation largely of Austral character dominated by such trees as sweet gum, tulip tree, beech and holly. There is a narrow sand beach along the river which supports a rather low percentage of ammophilous wasps, perhaps because most of the area is subject to inundation during storms. Adjacent to the beach are rather steep bluffs which are usually densely wooded. Some of the most fruitful collecting was made from tulip tree foliage in the zone between the bluffs and the beach. It cannot be stated that all species taken on this foliage are sylvicolous forms, but certainly most of them are.

A total of 90 species of wasps is recorded herein. The majority of those captured are Upper Austral in distribution or a combination of Upper Austral and Transition. The presence of a few Lower Austral intrusives—*Stigmus fulvipes, Gorytes floridanus* and *Bicyrtes fodiens*—is noteworthy. The most significant capture was the new species of *Thaumatodryinus*, a genus known definitely hitherto from three specimens representing two species from Australia and Trinidad, British West Indies, respectively.

I am indebted to the following specialists for identifications of the prey of several wasps discussed herein: W. H. Anderson (larvae of Coleoptera), B. J. Kaston (Araneae), and D. A. Young (Cicadellidae). The other identifications are my own.

Family **DRYINIDAE**

Aphelopus albopictus Ashmead. 1 ♀ ; July 8; on tulip tree foliage.

Deinodryinus atriceps (Brues). 1 ♀ ; July 6.

Deinodryinus variabilis Fenton. 1 ♀ ; July 8; on tulip tree foliage.

Thaumatodryinus perkinsi new species. 1 ♀ ; July 6. See Appendix for description of this species and notes on the genus.

Family **TIPHIIDAE**

Tiphia affinis Malloch. 2 ♂ ♂ ; July 6 and 8; in open woods.

Tiphia atlantis Allen. 1 ♀ ; July 6; in open woods.

Tiphia egregia Viereck. 1 ♂ ; July 6; in open woods.

Tiphia subcarinata Malloch. 3 ♀ ♀, 6 ♂ ♂ ; July 3-8; usually in open woods; 1 ♂ on tulip tree foliage.

Methocha (*Methocha*) *stygia* (Say). 1 ♀, 1 ♂ ; July 5 and 6; the female on sandy beach with sparse vegetation, the male on tulip tree foliage.

Myrmosa (*Myrmosa*) *unicolor* Say. 1 ♀, 1 ♂ ; July 5 and 7; in open woods.

Family **MUTILLIDAE**

Sphaeropthalma pennsylvanica pennsylvanica (Lepeletier). 1 ♀, 5 ♂ ♂ ; July 4-8; usually in open woods, the female crawling over logs in cabin wall in which *Symmorphus* and *Trypoxylon* were nesting.

Pseudomethoca frigida (Smith). 7 ♀ ♀ ; July 3-6; mostly in open woods.

Pseudomethoca simillima (Smith). 4 ♀ ♀ ; July 4-8; in open woods.

Family **VESPIDAE**

Polistes metricus Say. 3 ♀ ♀ ; July 4 and 8; in open woods.

Eumenes fraternus Say. 1 ♀ ; July 3; in open woods.

Pseudodynerus quadrisectus (Say). 4 ♀ ♀, 1 ♂ ; July 4-8; 1 ♀ in open woods.

Monobia quadridens (Linnaeus). 4 ♀ ♀ ; July 3-8; several in open woods.

Rygchium megaera (Lepeletier). 1 ♀ ; July 6.

Symmorphus canadensis (Saussure). 11 ♀ ♀, 5 ♂ ♂ ; July 3-8; most of them in open woods near log cabin and nesting in the logs; one pair on foliage of tulip tree.

Three of the females were captured as they hovered before their burrow entrances in the logs of the cabin wall. Two of them (7351 A and 7451 A) were taken on July 3rd and 4th respectively in mid-afternoon, each with a two-thirds grown, chrysomelid leaf-miner larva, *Chalepus* species (larvae of this genus are leaf miners in leguminous plants). The third female (7851 B) was taken at 1 : 30 P.M. on July 8th with a full-grown weevil larva, *Prionomerus calceatus* (Say) (larvae of this species are leaf miners in tulip tree or evergreen magnolia, and the former is undoubtedly the host plant in this instance).

This species [as *debilis* (Saussure)] has been recorded previously[1] as constructing cells with clay partitions in abandoned wood-boring beetle burrows. These cells were provisioned with larvae of leaf-mining Lepidoptera, *Antispila nysaefoliella* Clemens, from sour gum leaves.

Stenodynerus (*Parancistrocerus*) *pedestris pedestris* (Saussure). 1 ♀ ; July 8; in open woods.

Family **POMPILIDAE**

Chirodamus albopilosus (Cresson). 5 ♀ ♀, 2 ♂ ♂ ; July 4-8; 1 ♂ in open woods, the other specimens on tulip tree foliage.

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[1] Reinhard, E. G., 1929. The Witchery of Wasps, pp. 72-83.

Chirodamus fortis (Cresson). 9 ♀ ♀, 5 ♂ ♂; July 3-6; in woods.

One female was watched for 35 minutes while she hunted a spider. Her search was made on foot in and under leaf litter, and several times she made short flights of several feet to new areas. She was not successful in flushing a spider during the time she was under my observation.

Priocnessus nebulosus (Dahlbom). 2 ♂ ♂; July 5; on tulip tree foliage.

Priocnessus nuperus (Cresson). 1 ♂; July 6; on tulip tree foliage.

Dipogon (*Deuteragenia*) *papago* (Banks) (a new subspecies of, Townes MS). 1 ♀; July 5; on tulip tree foliage.

Priocnemis (*Myrmecosalius*) *cornica* (Say). 1 ♀, 8 ♂ ♂; July 6-8; 1 ♂ on tulip tree foliage.

Priocnemis (*Myrmecosalius*) *germana* (Cresson). 6 ♀ ♀, 7 ♂ ♂; July 3-8; most of them in open woods; 2 ♀ ♀ and 1 ♂ on tulip tree foliage.

Priocnemis (*Myrmecosalius*) *hestia* (Banks). 1 ♀; July 4; in open woods.

Calicurgus hyalinatus alienatus (Smith). 6 ♀ ♀; July 3-8; 1 ♀ in open woods and 3 ♀ ♀ on tulip tree foliage.

Phanagenia bombycina (Cresson). 1 ♀; July 3; in open woods.

Auplopus architectus (Say). 1 ♂; July 6; in open woods.

Auplopus mellipes (Say). 1 ♀; July 3; in open woods.

Minagenia n. sp. (Townes Ms). 1 ♂; July 2; in open woods.

Aporus (*Aporus*) *niger* (Cresson). 5 ♂ ♂; July 3-8; 1 ♂ in open woods, 2 ♂ ♂ on tulip tree foliage.

Psorthaspis mariae (Cresson). 1 ♀; July 4; in open woods.

Evagetes ingenuus (Cresson). 1 ♀; July 7.

Evagetes mohave (Banks). 1 ♀; July 5.

Agenioideus (*Agenioideus*) *humilis* (Cresson). 7 ♀ ♀, 7 ♂ ♂; July 3-8; most of them taken around cabin in open woods, but 5 ♂ ♂ on tulip tree foliage.

The females were nesting in crevices in the masonry of the foundations of the cabin in which we stayed. One female was observed dragging a small spider into a crevice.

Episyron biguttatus biguttatus (Fabricius). 1 ♀, 1 ♂; July 4 and 6; the female in open woods.

Anoplius (*Lophopompilus*) *cleora* (Banks). 6 ♀♀, 9 ♂♂; July 5-8; on beach.

One female (7751 A) was captured at 8:30 A.M. on July 7th dragging a large, paralyzed female lycosid spider, *Arctosa littoralis* (Hentz), over the sand. The spider had fully recovered from the paralysis that evening.

Anoplius (*Arachnophroctonus*) *americanus americanus* (Beauvois). 1 ♀, 3 ♂♂; July 6 and 7; all on beach at flowers of Virginia creeper.

Anoplius (*Arachnophroctonus*) *apiculatus pretiosus* (Banks). 1 ♀; July 6; on beach.

Anoplius (*Pompilinus*) *marginatus* (Say). 1 ♂; July 6; in open woods.

Anoplius (*Anoplius*) *ventralis ventralis* (Banks). 1 ♀; July 6.

Anoplius (*Anoplius*) *virginiensis* (Cresson). 3 ♀♀, 4 ♂♂; July 3-5; mostly in open woods.

Pompilus (*Anoplochares*) *apicatus* Provancher. 2 ♀♀; July 6 and 8; one in open woods, the other on tulip tree foliage.

Family **SPHECIDAE**

Astata (*Astata*) *unicolor* Say. 1 ♀; July 7.

Lyroda subita (Say). 2 ♀♀, 1 ♂; July 6 and 7.

Miscophus americanus Fox. 1 ♀; July 6; in open woods.

Tachysphex similis Rohwer. 1 ♂; July 7.

Tachysphex terminatus (Smith). 1 ♀, 3 ♂♂; July 6 and 7.

Motes argentata (Beauvois). 1 ♀; July 6; in open woods.

Trypoxylon (*Trypoxylon*) *adelphiae* Sandhouse. 6 ♀♀, 1 ♂; July 3-8; 2 ♀♀ in woods, and 3 ♀♀ and 1 ♂ on tulip tree foliage.

One female (7751 B) was caught on tulip tree foliage at 8:50 A.M. on July 7th with a very small, immature epeirid spider, possibly a species of *Araneus*, held in her mandibles.

Trypoxylon (*Trypoxylon*) *pennsylvanicum* Saussure. 1 ♀; July 3; in open woods.

Trypoxylon (*Trypoxylon*) *richardsi* Sandhouse. 1 ♀; July 4; in open woods.

Trypoxylon (*Trypargilum*) *clavatum* Say. 9 ♀ ♀, 7 ♂ ♂ ; July 3-8; most of them taken in woods, hovering before logs in cabin wall in which they were nesting; 1 ♂ on foliage of tulip tree.

Trypoxylon (*Trypargilum*) *politum* Say. 2 ♂ ♂ ; July 6 and 8; in woods.

Trypoxylon (*Trypargilum*) *rubrocinctum* Packard. 4 ♀ ♀, 1 ♂ ; July 3-8; 2 ♀ ♀ in open woods, 1 ♂ on tulip tree foliage.

Trypoxylon (*Trypargilum*) *striatum* Provancher. 2 ♀ ♀, 1 ♂ ; July 3 and 8; the females in open woods, the male on foliage of tulip tree.

Trypoxylon (*Trypargilum*) *tridentatum* Packard. 1 ♀ ; July 3; hovering before log in cabin wall in which it was nesting.

Diodontus (*Diodontus*) *trisulcus* (Fox). 1 ♀ ; July 6; on tulip tree foliage.

Psen (*Psen*) *monticola* (Packard). 1 ♀, 1 ♂ ; July 3; in woods.

Stigmus (*Stigmus*) *americanus* Packard. 1 ♀ ; July 3; in woods.

Stigmus (*Stigmus*) *fulvipes* Fox. 1 ♀, 2 ♂ ♂ ; July 7 and 8; on foliage of tulip tree.

The previously recorded distribution of this species has been California (type locality) and Nebraska. A search through the unidentified *Stigmus* in the collection of the U. S. National Museum has uncovered additional specimens from New Mexico, Texas, Iowa, Virginia and District of Columbia. The species is readily separable from the other eastern members of the genus by a combination of the bidentate mandibles and bilobate clypeus in female, and very large, coarse enclosed areas on propodeum in both sexes.

Spilomena pusilla (Say). 1 ♀ ; July 5; around log cabin walls.

Sphex urnarius (Dahlbom). 3 ♀ ♀, 2 ♂ ♂ ; July 6-8; 2 ♀ ♀ on tulip tree foliage.

Sceliphron caementarium (Drury). 1 ♀ ; July 6.

Alysson melleus Say. 8 ♂ ♂ ; July 5-8; three of them on tulip tree foliage.

Alysson oppositus Say. 11 ♀ ♀, 6 ♂ ♂ ; July 3-8; 3 ♀ ♀ and 2 ♂ ♂ in open woods; 4 ♀ ♀ and 4 ♂ ♂ on foliage of tulip tree.

Nysson (*Epinysson*) *hoplisivora* Rohwer. 1 ♀ ; July 5; in open woods.

Ochleroptera bipunctata (Say). 3 ♀ ♀, 16 ♂ ♂ ; July 3-8; almost all the specimens on foliage of tulip tree.

Psammaecius pergandei (Handlirsch). 3 ♂ ♂ ; July 7 ; on tulip tree foliage.

Gorytes (*Gorytes*) *simillimus* (Smith). 2 ♀ ♀ ; July 5 ; in open woods .

One of the females (7551 A) was captured as she hovered above her burrow entrance after camouflaging it with soil at 2 : 15 P.M. on July 5th. Upon excavation, the tunnel was found to penetrate the sandy loam soil at an angle of 45° to the horizontal, and contained a paralyzed, adult female leafhopper, *Gyponana* species, in a cell 1½ inches below the surface.

Gorytes (*Pseudoplisus*) *floridanus* Fox. 1 ♀ ; July 7 ; flying around stunted willow bush on beach.

This is the first published record north of Florida in the Atlantic states. In some material turned over to me recently from the H. S. Barber collection [USNM] is a female taken by him on July 12, 1931, 2.3 miles east of Piney Point, Maryland, a locality only a few miles down the Potomac River from Westmoreland State Park.

Bicyrtes fodiens (Handlirsch). 1 ♂ ; July 7 ; on beach.

Microbembex monodonta (Say). 1 ♀ ; July 3 ; on beach.

Philanthus gibbosus (Fabricius). 1 ♀ , 5 ♂ ♂ ; July 4-8 ; a small colony nesting in open woods near our cabin.

One female (7851 A) was captured while flying with her prey, the metallic green halictid bee, *Augochloropsis cuprea* (Smith).

Cerceris clypeata Dahlbom. 2 ♀ ♀, 18 ♂ ♂ ; July 5-8.

Cerceris fumipennis Say. 2 ♂ ♂ ; July 7.

Cerceris robertsonii Fox. 1 ♀ , 1 ♂ ; July 6 and 7.

Entomognathus (*Toncahua*) *memorialis* Banks. 1 ♀ ; July 6 ; on foliage of tulip tree.

Lindenius (*Trachelosimus*) *buccadentis* Mickel. 2 ♀ ♀ ; July 7 and 8 ; on tulip tree foliage.

Crabro (*Crabro*) *cribrellifer* (Packard). 1 ♀ ; July 8 ; on foliage of tulip tree.

Crossocerus (*Yuchiha*) *xanthochilos* Pate. 4 ♀ ♀ , 2 ♂ ♂ ; July 3-8 ; one female in open woods, the rest of the specimens on foliage of tulip tree ; one female with lumps of clay on right mid tibia and both hind tibiae indicating that it is a ground-nesting form.

The male of this species, the type of the subgenus *Yuchiha* Pate, has not been reported previously. The discovery of this sex re-

quires two modifications in the original subgeneric diagnosis [2] which was based on a Formosan species in the male sex. These are the changing of the characters of the antennal flagellum to indicate that it may or may not be fringed with hair beneath, and that a pygidial area delimited by lateral carinae may or may not be present on the last visible abdominal tergite. A similar variation in these two characters is found in *Crossocerus sens. str.*

The male of *xanthochilos* may be described briefly as follows:

Length 8.9 mm., forewing 6.3 mm. Color similar to that described for female except that scutellum may or may not have yellow, dorsum of abdomen is entirely black, and the venter is black except for apices of sternites which are reddish. Sculpture similar to that of female with following exceptions: head shinier, the punctures shallower and sparser; flagellum beneath with a fringe of hair; mandible bidentate at apex, the upper tooth longer and larger; mesosternum with a brush of moderately long, white hair anteriorly; fore trochanter and femur flattened and with dense, long white hair beneath, legs otherwise unmodified; last visible abdominal tergite with larger punctures than on preceding tergite, and with a definite broad, U-shaped pygidial area delimited by a carina continuous around posterior half and apical margin of tergite; sternites unmodified.

Crossocerus (*Crossocerus*) *lentus* (Fox). 5 ♀ ♀, 5 ♂ ♂; July 5-8; most of the specimens captured on tulip tree foliage.

Crossocerus (*Crossocerus*) *similis* (Fox). 2 ♀ ♀, 1 ♂; July 3-7; the females in open woods, the male on tulip tree foliage.

Crossocerus (*Blepharipus*) *tarsalis* (Fox). 1 ♀; July 3; in open woods.

Crossocerus (*Nothocrabro*) *nitidiventris* (Fox). 1 ♂; July 4; hovering before pile of fireplace wood outside cabin in open woods.

Lestica (*Solenius*) *producticollis* (Packard). 1 ♀; July 3; in woods.

Oxybelus emarginatus Say. 3 ♀ ♀, 1 ♂; July 7 and 8; this species is a ground-nesting form, and one of the captured females has small lumps of clay adhering to all tibiae except the right fore tibia.

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[2] Pate, V. S. L., 1944 (1943). The Subgenera of *Crossocerus* with a Review of the Nearctic Species of the Subgenus *Blepharipus*. Lloydia 6: 273-4.

Appendix

Notes on the Genus Thaumatodryinus Perkins, With Description of a New Species

The dryinid genus, *Thaumatodryinus* Perkins, is one of the more bizarre types in a family characterized by a multitude of grotesque forms. It is separated from all other genera in the family by the presence of two preapical, lamellate teeth on the enlarged claw of the fore tarsus (figs. 1a-3a), certain antennal characters and the form of the head. The antennae (fig. 2b) are filiform, very elongate, slightly longer than to a fourth again as long as the body length, and bear on the fifth to tenth segments tufts of a few long, curved sensory hairs. These tufts of modified hairs are located one about the middle of each segment except that the tenth has a preapical tuft in addition. It is the only member of the Dryinini having so broad a head combined with a vertex which is not flat or concave (figs. 1-3).

The genus was based on *T. koebelei* Perkins (Hawaii. Sugar Planters' Assoc. Expt. Sta., Div. Ent. Bul. 1: 58, 1905), described from a unique specimen from near Cairns, Queensland, Australia. This specimen was reared by A. Koebele from a nymphal fulgorid, *Siphanta* species. A second species, *T. rufus* Richards (Ann. Mag. Nat. Hist. (12) 4: 815, 1951), was described from two specimens from St. Augustine, Trinidad, British West Indies. These were reared by J. L. Gregory from a fulgorid, *Ormenis* species, on cacao. There is some doubt as to whether the three species of Baltic Amber Dryinidae referred to *Thaumatodryinus* by Brues actually belong to that genus. One of them, *Dryinus filicornis* Brues, has been made the type of *Harpactosphecion* Haupt. If Haupt's identification of *filicornis* is correct, it certainly does not belong in *Thaumatodryinus*.

Certain ambiguities in the original generic diagnosis caused me to wonder whether my specimen from Virginia was actually congeneric with the Australian species. E. C. Zimmermann, of the Hawaiian Sugar Planters' Association, very kindly placed in my hands for study the unique type of *koebelei* Perkins. O. W. Richards was equally generous in sending me for examination the

paratype of *rufus* Richards in his personal collection, and in furnishing certain measurements of the type. Comparison of the three species convinces me that they are congeneric and that no basis exists for even subgeneric differentiation. A revised and clarified generic diagnosis for *Thaumatodryinus* based on the three extant species may be given as follows:

Female.—Maxillary palpi six-segmented, labial palpi three-segmented. Mandibles quadridentate. Apical margin of clypeal lobe truncate. Malar space oblique, elongate, traversed by a fine carina extending from just above lower mandibular condyle to lower posterior margin of eye. Head transverse (figs. 1-3), the eyes strongly bulging, the height (from apex of clypeus to occiput) .63-.69 the greatest width, the ocellar area raised and the vertex between ocelli and eye straight, not concave; occipital carina present dorsally. Antennae filiform and very elongate, the length from 1.03 to about 1.25 the body length; flagellar segments (fig. 2b) increasing gradually in length from the first to the fourth, and then decreasing gradually in length to the seventh, the last (eighth) slightly longer than the seventh; the fifth to tenth antennal (third to eighth flagellar) segments each bearing a median tuft of several long, curled sensory hairs, the tenth with a subapical tuft also. Pronotum with posterolateral angles reaching the tegulae, dorsally with a weak, very shallow transverse impression, the anterior width seven-eighths the width of scutum between tegulae. Tibial spurs 1, 1, 2. Anterior trochanters slender, from 0.40 to 0.45 as long as fore femora. Enlarged claw of fore tarsus (figs. 1a-3a) with a row of peg-like setae ("lamellae") extending almost to apex, the preapical area with two lamellate teeth, the apex with a flattened seta apposed to the curved tip of the claw; pulvillus and small claw present; fifth tarsal segment with basal prolongation extending back to base of third tarsal segment which is hollowed out to receive the tip, the inner edge with two rows of peg-like setae extending almost to tip, the curved tip with a group of four such setae. Fully winged, stigma well developed and lanceolate, radial vein of forewing extending two-thirds of distance to wing margin, the costal vein extending from stigma two-thirds the distance to apex of marginal cell (the lower outer third of marginal cell delimited by a darkening of the wing membrane).

Male.—Unknown.

The females of the three extant species of *Thaumatodryinus* may be separated by the following diagnoses:

Length 4.5-5.5 mm., forewing 3.7-4.3 mm.; head and thorax reddish, the latter darker beneath, abdomen reddish-testaceous, base of abdominal petiole black; palpi, antennae and legs testaceous, fore and hind femora dark brown except for narrow basal and apical rings of testaceous; wings clear except for an indistinct dark band beneath stigma; head as

figured (fig. 3), the eyes comparatively larger than in other two species, the middle interocular distance (at level of tops of antennal scrobes) .49 the head width, the eye height .65 the head height (apex of clypeus to occiput); postocellar line .34 the ocellocular line; antennae about 1.08 as long as whole body [missing in paratype beyond first flagellar segment], ratio of flagellar segments as 100:108:154:156:125:81:42:50; mesonotum with normally exposed area transversely to obliquely striate, notaulices absent; mesopleuron and propodeum regularly and coarsely reticulate; chela as figured (fig. 3a); Trinidad, B. W. I.

T. rufus Richards

Length 3.4 mm.,[3] forewing 3.1 mm.; head, thorax and abdomen reddish-testaceous, base of abdominal petiole black; palpi, antennae and legs testaceous, except apical six flagellar segments dark brown; wing membrane entirely clear; head as figured (fig. 1), the eyes comparatively smaller than in *rufus*, the middle interocular distance .57 the head width, and eye height .60 the head height; postocellar line .54 the ocellocular line; antennae 1.25 as long as body, ratio of flagellar segments as 100:120:155:159:125:64:36:46; mesonotum with normally exposed area delicately alutaceous, notaulices feebly developed and slightly converging posteriorly; mesopleuron finely alutaceous above, finely reticulate below, propodeum more coarsely reticulate; chela as figured (fig. 1a); Queensland, Australia ..... **T. koebelei** Perkins

Length 3.5 mm., forewing 3.1 mm.; head, thorax, abdomen and appendages reddish-testaceous, the base of abdominal petiole black and apical six flagellar segments brown; wing membrane entirely clear; head as figured (fig. 2), the eyes comparatively smaller than in *rufus*, the middle interocular distance .59 the head width, and eye height .59 the head height; postocellar line .65 the ocellocular line; antennae (fig. 2b) 1.03 as long as body, ratio of flagellar segments as 100:110:167:190:149:103:69:82; mesonotum with normally exposed area delicately alutaceous, notaulices strongly developed and slightly converging posteriorly; mesopleuron finely alutaceous above, finely reticulate below, propodeum more coarsely reticulate; chela as figured (fig. 2a); Virginia, U. S. A.

T. perkinsi[4] new species

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[3] The type of *koebelei* is glued on a card and the first abdominal segment is straightened out instead of being at an angle to the rest of the abdomen as in *rufus* and *perkinsi*. Measurements of the body length of the latter two species have been made as if the abdomens were extended similarly.

[4] *Type*.—♀; Westmoreland State Park, Westmoreland County, Virginia; July 6, 1951 (K. V. Krombein; taken while crawling on leaf of tree at 8 a. m.) [deposited in U. S. National Museum].

Named for R. C. L. Perkins in recognition of his able basic classification of this difficult family.

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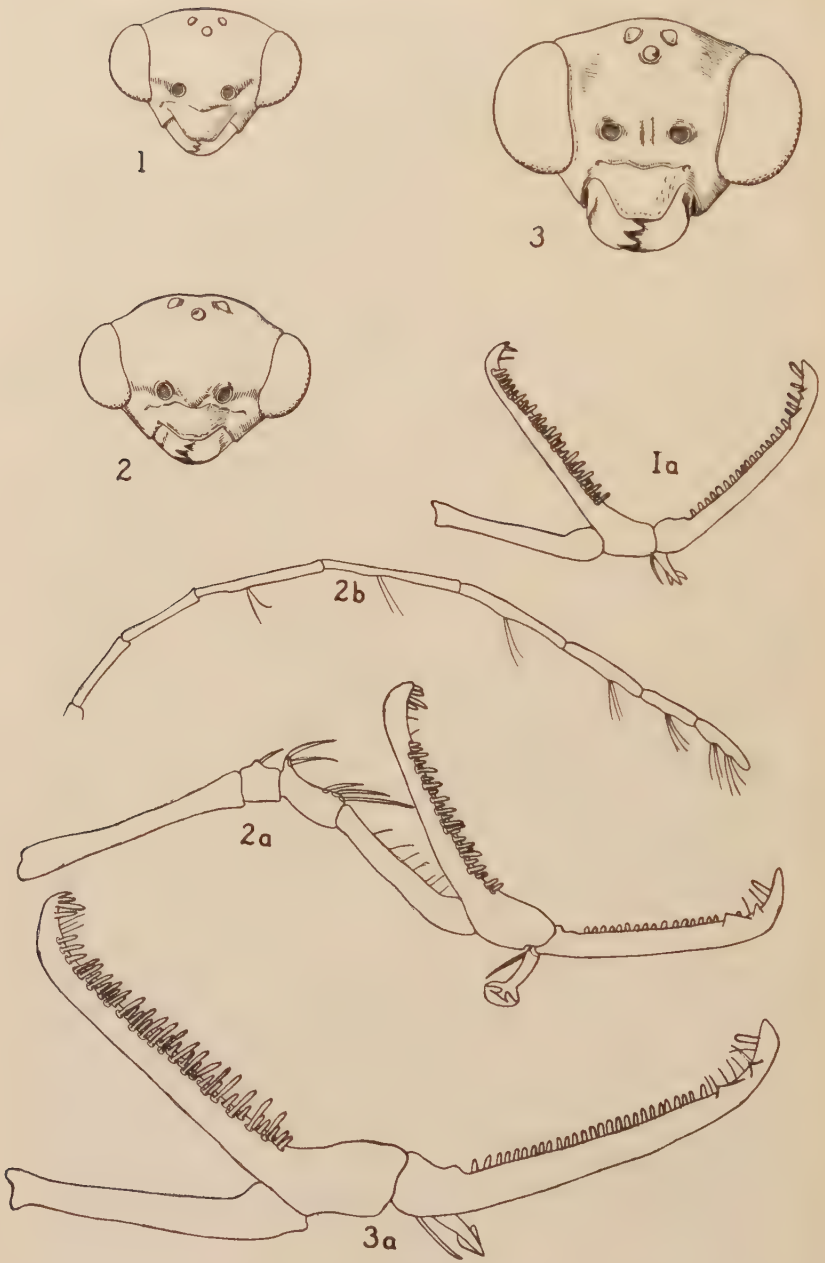

Fig. 1, *Thaumatodryinus koebelei* Perkins (type) ; fig. 2, *T. perkinsi*, n. sp. (type) ; fig. 3, *T. rufus* Richards (paratype). Figs. 1-3, head; figs. 1a-3a, chela of fore tarsus (2a shows entire tarsus) ; fig. 2b, flagellum of antenna. (Figures 1-3 by Arthur D. Cushman, figures 1a-3a and 2b by author from slide mounts.)

TWO NEW MELANOPLOID GENERA (ORTHOPTERA: ACRIDIDAE: CYRTACANTHACRIDINAE) FROM THE WESTERN UNITED STATES

BY JAMES A. G. REHN

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In papers presented some years past the author and John W. H. Rehn described the apterous or subapterous genera *Prumnacris* and *Buckellacris* [1] from the northwestern United States, in the case of the latter genus from adjacent Canada as well. In the same studies it was brought out that to the genera *Bradynotes* and *Asemoplus* a number of species had been referred which are not congeneric with their genotypes.

At this time it is possible to broaden this analysis of certain elements which had been referred to *Bradynotes* and which it is now evident are generically separable, also to describe a very distinctive new genus of similar broad relationship, from the Olympic Peninsula of Washington.

Full revisions of the species of both *Bradynotes* and *Asemoplus* are partially completed, and it is hoped they may see the light in the near future.

NISQUALLIA [2] new genus

This very distinctive genus is a member of the *Bradynotes* complex of the Melanoplini. Its nearest relative among described genera

[1] Studies of Certain Cyrtacanthacridoid Genera (Orthoptera: Acrididae). Part. II. Prumnacris, a New North American Genus of Holarctic Type. Trans. Amer. Entom. Soc., LXX, pp. 1-21, 20 text-figs., pls. I and II (1944).
Studies of Certain Cyrtacanthacridoid Genera (Orthoptera: Acrididae). Part III. Buckellacris, Another New North American Genus of Holarctic Type. Trans. Amer. Entom. Soc., LXXI, pp. 1-45, 1 map, 21 text-figs., pl. I (1945).

[2] From the Nisqually people of the Puget Sound region.

is clearly *Bradynotes* Scudder (genotype *B. obesa* (Thomas)), with which it agrees in general build, more nearly in its general head and pronotal structure than with any other, in its apterous condition, its general thoracic proportions, and its very weakly tuberculate and non-spinose prosternal development. It differs from *Bradynotes* chiefly in its more markedly fusiform build in the female, in the much narrower fastigium in the male, in the continuously marked frontal costa and the far more decided lateral facial carinae in both sexes, in the proportionately shorter metazona, in the more deeply impressed principal sulcus of the pronotum, in the greatly reduced and pore-like tympanal areas, in the mesosternal interspace exceeding the breadth of one of the mesosternal lobes, and in all the femora being more slender and less tumid.

When compared with *Hebardacris,* here described, *Nisquallia* is at once separable by its more pronounced fusiform build in the female, by the markedly carinate lateral borders of the fastigium and frontal costa in the male, the well-marked lateral facial carinae, the far broader metanotum in the female, and the less prominent eyes.

With *Asemoplus* Scudder (genotype *A. montanus* (Bruner)) *Nisquallia* has no close relationship, and from *Buckellacris* Rehn and Rehn [3] (genotype *B. chilcotinae* (Hebard)) it also shows many differences, among them the much more fusiform build in the female, the narrower interocular space and fastigium in both sexes, but more markedly so in the male, in the lack of any transverse interruption of continuity of the fastigial and frontal costal impressions in the same sex, the frontal costa being definitely sulcate and well-marked to the clypeal suture, in the well-marked lateral facial carinae, the greatly reduced tympanal areas, the low rounded and non-conical prosternal process, in the mesosternal interspace exceeding the lobal breadth, and also in the external genitalia of the male lacking furcula.

From *Prumnacris* Rehn and Rehn [4] (genotype *P. rainierensis* (Caudell)) *Nisquallia* is widely distinct, being entirely apterous, having the pronotum shorter and more quadrate (♂) or more transverse (♀) in general outline, with the metazona very much

[3] Trans. Amer. Entom. Soc., LXXI, p. 2 (1945).

[4] Trans. Amer. Entom. Soc., LXX, p. 2 (1944).

shorter in both sexes, while most all the other features of difference from *Bradynotes* or *Buckellacris* here cited apply equally well in considering *Prùmnacris*.

At this time it seems undesirable to review differences from certain Old World genera of the Melanoplini, as it will be more advantageous to do this later in a now partially completed study of *Bradynotes* and its nearer relatives.

GENOTYPE: *Nisquallia olympica* new species.

Generic features.— Apterous. Form lightly (♂) to quite markedly (♀) fusiform; surface of certain areas very sparsely pilose, this most noticeable on the limbs. Head hardly (♂) to appreciably (♀) broader across the genae than across the eyes; fastigium appreciably declivent ventro-cephalad to the narrowly rounded obtuse fastigio-facial angle as seen in profile, in ♀ as seen from the dorsum broader than long at base (across lateral ocelli), its disk shallowly excavate, lateral bounding carinae well-marked in ♂, low and little evident in ♀, in the former continued caudad over the interocular space, which in that sex is not broader than one-third of greatest eye-breadth in same aspect, in ♀ the same breadth surpasses half that of eye; frontal costa relatively narrow with subparallel carinate lateral borders continuous with those of the fastigium and reaching to the clypeal suture in the ♂, broader, faintly expanding from base to ocellar area and then subequal in breadth ventrad in the ♀, sulcate throughout in the ♂, impressed about the ocellus and sulcate for some distance ventrad of same in ♀; lateral facial carinae well-marked in both sexes; lateral ocelli similarly developed; eyes but moderately prominent in ♂ as seen in both dorsal and cephalic aspects, in ♀ somewhat less so; antennae of medium length,[5] composed of 21 to 23 articles.[6] Pronotum short, weakly (♂) to quite markedly (♀) expanded caudad, greatest pronotal breadth slightly less than (♂) or distinctly exceeding (♀) the length of the same, caudal margin of pronotal disk transverse, virtually truncate; metazona very short, less than half as long as the prozona, three transverse sulci evident on disk, the second and the principal one also present on lateral lobes, the principal one continuously, the second interrupted at lateral shoulders, the first of the dorsal group curving cephalad and terminating at the lateral shoulders, median carina very weak and subobsolete between first and principal transverse sulci, lateral shoulders distinct but rounded, more evident and more tumid in the ♂ than in the ♀, not carinate, not linearly continuous; lateral lobes subquadrate in outline, cephalic and caudal margins of lobes virtually subparallel, ventral margin low arcuate (♂) or subtruncate (♀) caudad, sinuately ascending cephalad, surface of lateral lobes with a cephalic intramarginal sulcus well impressed, plus the

[5] The single known male lacks complete antennae.

[6] The probably adventitious subdivision of some articles may be responsible for this range.

marked continuation of the second dorsal and that of the less deeply sculptured and less extensive principal one, median intersulcal sections of surface relatively tumid, especially in the ♂, surface of metazonal portion and more ventral sections of the lobes irregularly impresso-punctate, the metazona of disk also weakly so. Mesonotum, metanotum and proximal abdominal tergite very broad and much exceeding the breadth of the pronotal dorsum in the ♀, much less expanded, yet broader than pronotal dorsum, in the ♂, median carina evident in ♂, subobsolete in the ♀, surface of the same areas roundly tectate transversely in the ♀, more angularly so with more evident lateral borders to the dorsal section of the proximal tergite in the ♂; tympanal area not defined. No furcula present in ♂; supra-anal plate of ♂ scutellate with sinuate lateral borders; ♂ cerci simple, styliform, reaching to apex of supra-anal plate; subgenital plate of ♂ short, with a weakly indicated apical production; ♀ supra-anal plate simple, trigonal; cerci of ♀ very short and blunt, falling far short of apices of infra-cercal plates; ovipositor values of ♀ of normal melanoploid type, short, the dorsal ones relatively broad; subgenital plate of ♀ with distal margin trigonally produced mesad. Prosternal process a low rounded boss with its greatest dimension transverse and somewhat more elevated in the ♂ than the ♀. Meso-metasternum broad and bradynotoid in the ♀, much less so in the ♂; mesosternal interspace broader (♂) or very much broader (♀) than one of the mesosternal lobes; metasternal interspace appreciably narrower (♂) or slightly broader (♀) than one of the metasternal lobes. Cephalic and median femora appreciably inflated in the ♂, relatively slender and uninflated in the ♀; caudal femora relatively slender in both sexes, genicular lobes with their outline well rounded distad; caudal tibiae with 6-8 external, 8-9 internal spines; caudal tarsi relatively elongate,[7] arolia well developed.

Distribution.—The genus is known only from the type locality in the southern section of the Olympic Mountains of the Olympic Peninsula of Washington. In Pleistocene times of maximum glaciation the whole Olympic area was isolated eastward and northward by the great Puget Sound glacier.

Remarks.—The very distinctive and markedly individual character of this genus gives it a relatively unique position. Its wide divergence from other bradynotoids is especially evident in the female sex, yet its nearest affinities are clearly with *Bradynotes.* We know nothing further regarding the bionomics of this genus and species than the information on the labels quoted below. Further information will be most welcome, as conceivably it may furnish some clues to numerous puzzling angles developed in a study of its nearest relative the genus *Bradynotes,* its origin and movements, as well as its sometimes contradictory distributional tendencies.

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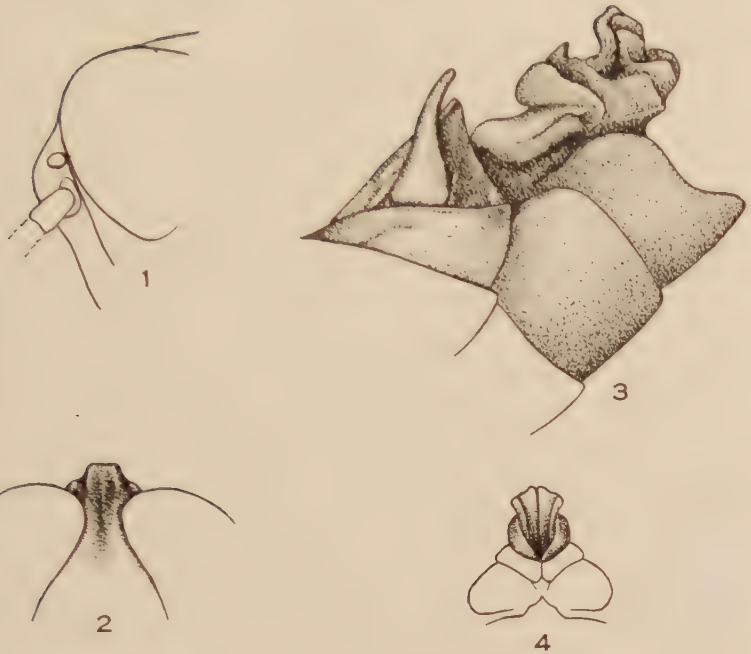
[7] This is particularly evident when compared with *Bradynotes.*



Nisquallia olympica new genus and species. Mount Ellinor, Mason County, Washington. Male (allotype). Fig. 1.—Lateral outline of fastigio-facial angle. Fig. 2.—Dorsal view of fastigium. Fig. 3.—Lateral view of apex of abdomen (internal genitalia extended). Fig. 4.—Aedeagus in caudal aspect. (All greatly enlarged.)

Nisquallia olympica[8] new species Text-figs. 1-4; pl. IV, figs. 5-11.

Type.— ♀[9]; Mount Ellinor, Mason County, Washington.[10]

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[8] In relation to the isolated character of the Olympic Peninsula, its imposing mountain mass, and the endemism of some of its life elements.

[9] While it is customary in dealing with melanoploids to select the male sex when describing new species, in the case of the present genus its more pronounced differential characters are more evident in the female sex, and further the single known male—here described as the allotype—lacks one caudal limb, and its antennae, and the sole remaining caudal tibia may be teratological in its evident curvature.

[10] Mt. Ellinor is in the southeastern section of the Olympic uplift, its position approximately 123° 15′ W., 47° 31′ N. Its summit is about one mile southwest of that of Mt. Washington, which latter reaches an elevation of 6250 feet, while that of Mt. Ellinor is given as 5940. Mt. Ellinor will be found on the Mt. Constance quadrangle of the U. S. Geological Survey topographic charts. We have no information as to the elevation at which the material of *Nisquallia* was secured.

August 17, 1922. (P. G. Putnam.) [Academy of Natural Sciences of Philadelphia, Type no. 5769.]

Form in dorsal aspect rather strongly fusiform, the greatest body breadth across the metapleura equal to one-third of body length; surface texture as a whole smooth, dull on dorsal surface, weakly polished areally laterad and moderately shining ventrad, very sparse pilosity, chiefly noticeable on limbs, very little evident and usually marginal.

Head in dorsal view relatively short and narrowing cephalad, the dorsal length two-thirds that of pronotal dorsum, in facial aspect relatively broad across the genae, narrowing dorsad to the eye outline,[11] the greatest breadth across the subtumid genae being nearly 1.2 times that across head where the lateral outlines of the genae meet those of the eyes (as 4.1 to 3.5), greatest head depth (including mouth-parts) approximately 1.3 times the greatest head breadth (as 5.5 to 4.1); fastigium with its greatest breadth across lateral ocelli equal to 1.5 times the fastigial length cephalad of the least interocular space as seen from the dorsum, its disk very shallowly concave, the lateral margins very low and but weakly carinulate, yet evident, obtuse-angulately exserted toward lateral ocelli, cephalad passing evenly into the bordering margins of the frontal costa; interocular space broad, equal in breadth to three-fourths the greatest transverse dimension of one of the eyes as seen from the dorsum; occiput arcuately elevated; frontal costa relatively broad, moderately and evenly expanding from the rounded fastigio-facial passage to the area of the median ocellus, thence ventrad of subequal breadth, that at median ocellus slightly less than least interocular space (as 17 to 20) and slightly more than 1.5 times that of the costa where it passes into the fastigium (as 17 to 11), lateral borders of costa evident virtually to the clypeal suture, surface of frontal costa punctate and plane, except for being shallowly sulcate for approximately half the distance from the median ocellus to the clypeal suture; lateral facial carinae distinct, gently and regularly divergent ventrad; eyes little prominent, in cephalic aspect not extending dorsad as far as the occipital outline, laterad their outlines are almost continuous with those of the genae, basal outline as seen in profile quite broad ovoid trigonal, the apex ventrad, greatest longitudinal dimension contained faintly less than 1.25 times in the greatest depth of the same, the latter subequal to the length of the infra-ocular sulcus. Antennae equal to approximately four-fifths of the combined length of the head and pronotum.

Pronotum transverse as seen from the dorsum, short, moderately sellate but not at all concave dorsad, moderately broadening ventrad, greatest breadth across ventro-caudal angles of lateral lobes equal to 1.6 times the median length of the dorsum (as 42 to 26), dorsal line of pronotum as seen in profile virtually straight; cephalic margin of disk very low arcuate with a distinct but shallow subobtuse-angulate median emargination, caudal margin arcuato-truncate with a very weak and shallow median subobtuse-angulate

[11] In this view this species has essentially the same head outline, except for the more prominent eye outline, as the same sex of *Bradynotes obesa*.

emargination, this margin laterad passing evenly into the subvertical caudal margin of the lateral lobes; transverse sulci of the dorsum three in number, the first and third (principal) not broken mesad, the second narrowly broken at median line, where evident the sulci are all finely and narrowly etched; prozona 2.5 times as long as the metazona; median carinula briefly indicated near cephalic margin and evident but low on the metazona, not indicated elsewhere; lateral shoulders evident but low tumidities, one extending cephalad of the second transverse sulcus, and this blocking the passage of the first transverse sulcus to the lateral lobes, the other between the second and principal sulcus, neither truly carinate, metazona lacking any similar structure, its dorsal surface passing evenly into the lateral lobes; lateral lobes roughly quadrate, their greatest dorsal length (at line of lateral tumidities) slightly greater than the lobar depth thence ventrad, cephalic margin of lobes subsinuately vertical, ventro-cephalic angle obtuse-angulate, ventral margin obliquely concave-emarginate in cephalic half, weakly oblique subtruncate in caudal half, ventro-caudal angle narrowly rounded subrectangulate, caudal margin virtually straight subvertical, surface of lateral lobes deeply cut by the continuations of the second and principal transverse sulci, the surface ventrad between the two as a whole more impressed than elsewhere, cephalic intra-marginal sulcus evident on the lateral lobes, particularly about the line of the lateral tumidities. Mesonotum short and strongly transverse, on median line no longer than the prozona cephalad of the first transverse sulcus, its breadth at caudal margin but little less than that of the pronotum across lateral lobes and equal to 1.2 times that of the dorsum of the pronotal metazona, caudal margin straight transverse, no median carinula; metanotum slightly narrower caudad than the mesonotum, of very similar structure, no median carinula, its caudal margin shallowly obtuse-angulate emarginate; proximal abdominal tergite much as meso-metanota but its dorsal surface narrows caudad and is trapezoidal in outline, with the deflexed lateral sections included its breadth is roughly subequal to that of the metanotum, with an appreciable median tectation, tympanal areas not defined, surface there slightly roughened; abdominal tergites two to eight, similarly low tectate, this most evident on seventh and eighth.

Prosternum mesad with a low rounded nodose swelling, transversely disposed in its greatest basal dimension, its surface arcuate both longitudinally and transversely, the fossae of the caudo-lateral sections of the prosternum quite deeply but narrowly excavate, a transverse subarcuate carinula of the prosternal surface extending caudad of the tubercle and fossae across the whole breadth of the prosternum between its lateral margins: meso-metasterna broad, relatively deplanate; interspace between mesosternal lobes very shallow, strongly transverse, in breadth equal to 1.4 times that of one of the mesosternal lobes, the cephalic border of the interspace shallowly biconcave, the internal margin of the mesosternal lobes rather broadly arcuate caudo-laterad; metasternal interspace similarly very shallow and strongly transverse, in breadth subequal to that between the mesosternal lobes, the cephalic margin of the metasternal interspace between the fossae shallowly concave,

internal margin of the metasternal lobes rather sharply rounding caudo-laterad.

Supra-anal plate subpyramidically trigonal in outline as seen from dorsum, its greatest proximal breadth but faintly less than its median length; immediate apex rather blunted subrectangulate, the plate in profile with its dorsal line nearly straight oblique, yet very shallowly concave for much of its length, surface proximad broadly and arcuately declivent ventro-laterad, these laterally declivent sections narrowing greatly distad; cerci short, not extending distad of middle of supra-anal plate, relatively thick, styliform, strongly tapering, apex narrowly blunted; infra-cercal plates very large, their apices very appreciably surpassing that of supra-anal plate, their ventral margin shallowly arcuate, their apices subacute, their external surface broadly and shallowly grooved but with a distinct elevated and arcuate ventral border to this impression; dorsal ovipositor valves relatively stout and short, but moderately recurved dorsad at apices, ventral ovipositor valves with their apical sections relatively slender, but moderately decurving, their ventral surface much excavate, the proximo-lateral tooth relatively strong and angulate, its complementary one on the internal margin smaller but evident, lateral plates of ventral ovipositor valves narrow, moderately acute in outline, their ventral margin shallowly arcuate, their dorsal shallowly concave; subgenital plate broad, the ventral surface shallowly rounded both longitudinally and transversely, distal margin with obtuse-angulate convergent lateral sections joining in an acute median spiniform intervalvar production.

Cephalic and median limbs of average build, the cephalic femora faintly shorter than the pronotal dorsum (as 25 to 27), the median femora subequal to the pronotal length. Caudal femora with their greatest depth contained approximately four times in their greatest length (as 18 to 73), with the greatest depth at proximal third, while the femoral form is not at all bullate as seen in profile and is essentially as in related genera with non-bullate femora, as seen from the dorsum they are relatively thick for their depth, external pagina with the chevron pattern regular and rather deeply engraved, outline of genicular lobes rather broadly arcuate, faintly sinuate preapically, their distal notch very shallow and weak; caudal tibiae somewhat shorter than the femora (as 67 to 75), straight, armed on external margin with 8-9 spines, internal with 9, internal tarsal spurs relatively long and falcate in distal half; caudal tarsi less than half as long as the tibiae (as 30 to 67), proximal article with its greatest length (i. e. ventrad) subequal to that of the distal one.

Allotype.— ♂ ; same data as type. [Academy of Natural Sciences of Philadelphia.]

Differing from the preceding description of the female sex (type) in the following noteworthy respects, some of which have already been summarized under the generic description.

Much less fusiform than the female, as a whole more subequal in breadth, more nearly of the build of the majority of the melanoploid genera, the greatest breadth across the metapleura equal to but seven twenty-fifths of the body length; surface texture of the thoracic dorsum slightly rougher than in the female, the lightly polished areas and the degree of pilosity as in female.

Head less strongly transverse than in the female, the greatest breadth across eyes equal to more than 1.4 times the dorsal length of the head (as 8.5 to 6), the dorsal length slightly more than four-fifths that of the pronotal dorsum (as 6 to 7.5), in facial aspect the head is distinctly narrower than in the female, the greatest breadth across the genae contained over 1.4 times in the greatest head depth (as 8.3 to 12), or but slightly more than that across the head where the lateral outlines of the genae meet those of the eyes (as 8.3 to 8.2), the genal outlines thus narrowing hardly at all dorsad; fastigium very much narrower than in female, its greatest breadth across lateral ocelli equal to 1.25 times the fastigial length cephalad of the least interocular space as seen from the dorsum, its disk longitudinally and narrowly excavate, this passing without a clearly defined break into the sulcus of the frontal costa, although in profile a definite fastigio-facial obtuse-angulation is recognizable, lateral margins of fastigial disk low but well evident, their greatest separation on line with caudal border of lateral ocelli, thence weakly convergent cephalad and passing into the lateral borders of the frontal costa, caudad of the point of greatest divergence the margins are more appreciably convergent to the least interocular space, then becoming subobsolete, breadth of least interocular space (between eye borders) hardly equal to one-third of the greatest transverse dimension of one of the eyes as seen from the dorsum, or subequal to greatest breadth of fastigial disk, excavation of which latter is carried caudad through the interocular space and actually on to the occipital surface, which latter is slightly more arcuately elevated than in the female; frontal costa relatively narrow, its lateral well-carinate margins subparallel and continuous ventrad over the whole depth of the face, sulcation of the frontal costa evident throughout, somewhat deeper in the inter-antennal section; lateral facial carinae more sharply elevated than in female but in disposition and trend as in that sex; eyes larger and more prominent than in female, especially as seen from dorsum, in cephalic aspect rising somewhat dorsad of interocular space and even of the occipital outline, in this aspect their lateral outlines are well cut off from those of the genae, basal outline subcircular, but faintly deeper than broad, a faint angulation or apex ventrad, the greatest depth of the outline is but slightly greater than the length of the infra-ocular sulcus. Antennae lacking in the allotype.

Pronotum weakly transverse, its greatest breadth across the ventro-caudal section of the lateral lobes equal to 1.3 times the median pronotal length (as 22 to 17), as seen from the dorsum with the surfaces of the lateral lobes subparallel and the whole pronotal form is by no means as sellate as in the female, while such caudal broadening as is indicated is very slight, dorsal

line as seen in profile nearly straight; dorsal margins as in female; transverse sulci more deeply etched than in female, the second briefly interrupted laterad on the disk before reaching the lateral shoulders; prozona not quite 2.3 times as long as the metazona (as 34 to 15); median carinula distinct but low on the metazona, less definite and chiefly a broad swelling on the prozona; lateral shoulders more evident than in the female, being roughly subparallel longitudinal swellings of the same general pattern as in the female but proportionately stronger and broader, the first transverse sulcus also sinuously breaking through and connecting with the intra-marginal sulcus of the lateral lobes, in no case are the shoulders truly carinate, metazonal shoulder as in female but more sharply pronounced and in section rounded angulate, the dorsal and lateral surfaces of the metazona while similarly impresso-punctate are well separated; lateral lobes in proportions and outline essentially as in female, the intra-marginal sulcus more evident, particularly dorsad, while the impression of the area between the second and principal sulci is less pronounced and its surface more linearly rugulose than in the female. Mesonotum much less expanded laterad than in the female, its greatest breadth not quite equal to 1.1 times that across the dorsum of the pronotal metazona (as 58 to 53), caudal margin virtually transverse-truncate, a fine median carinula present; metazona cephalad subequal in breadth to the mesonotum, slightly narrowing caudad, caudal margin shallowly obtuse-angulate emarginate, a distinct subtectate median carinulation present, dorsal surface laterad faintly excavate; proximal abdominal tergite with its dorsal surface trapezoidal, regularly and markedly narrowing caudad, median tectation pronounced and increasing in height caudad, the caudal margin of the tergite with an appreciable intra-marginal paralleling low tumidity, this rough and not at all sharp but marked, converging shoulders mark off the dorsum of the tergite from the subvertical lateral sections, tympanal area as in female; succeeding abdominal tergites with their median tectation low but evident.

Prosternum as in the female but with nodose swelling slightly more elevated; meso-metasterna, in agreement with general build, less strongly deplanate and narrower than in female; interspace between mesosternal lobes less transverse, equal to but 1.1 times the breadth of one of the lobes, its cephalic border virtually truncate, the internal margin of the lobes rather more obliquely arcuate caudolaterad than in the female; metasternal interspace not more than half the breadth of the mesosternal one, its cephalic margin truncate, the meso-caudal margin of the metasternal lobes definitely oblique arcuate caudo-laterad.

No furcula present; supra-anal plate scutelliform, its greatest proximal breadth subequal to the median length, lateral margins sinuately converging to the rectangulate apex, surface in proximal two-thirds moderately elevated and rounded and bearing a shallow median sulciform impression which becomes obsolete mesad of the middle, areas of surface laterad of the median elevation appreciably excavate, flanked internally at approximately the end of the median elevated area by paired low short subarcuate carinulae, these

directed caudo-laterad but not reaching the lateral margins, surface of immediate apex subdeplanate; cerci styliform, tapering as seen in profile with distal fourth slightly decurving, reaching as far distad as the apex of the supra-anal plate, greatest depth at base equal to half the cercal length, as seen from dorsum the cerci are moderately compressed proximad, virtually straight in the same view, also definitely tapering distad; infra-cercal plates not surpassing the apex of the supra-anal plate, the external margins of these obliquely converging to the blunt acute apices as seen from the dorsum; subgenital plate short, with a very blunt apex, the converging dorsal margins arcuate as seen from the dorsum, no definite apical tubercle present. Epiphallus and aedeagus as figured.

Cephalic and median femora distinctly inflated, in actual length but slightly shorter than in the female, but proportionately the cephalic femora are but five-sevenths the length of the pronotum, the median ones but two-thirds as long. Caudal femora with their apices but very faintly surpassing that of the abdomen, their greatest depth contained 3.7 times in their greatest length (as 14 to 52), their general shape as in the female but more robust as seen in profile, with the same relative marked thickness as viewed from the dorsum, pattern of pagina and genicular lobes as in female; caudal tibiae appreciably shorter than the femora (as 44 to 52), somewhat more robust than in female,[12] marginally with 6 external[13] and 9 internal spines.

Measurements (in millimeters)

Mt. Ellinor, Washington	Length of body	Length of antenna	Length of pronotum	Greatest breadth of pronotum	Length of caudal femur
♀, *type*	25.2	7.3	4.2	6.8	11.8
♀, *paratype*	21.3	7.0	4.0	6.0	11.0
♂, *allotype*	15.6	—[14]	2.77	3.5	8.4

The limited series of females before me shows a size range covered by the above measurements of that sex.

Coloration.—Dull and inconspicuous, usually mottled or clouded irregularly, the general body tone in the female with one extreme showing a pale base of clay color largely overlaid with a mantling wash of blackish brown, the opposite one almost entirely blackish brown with little pale contrast (type representing this condition); the pale areas when evident are on the sides of the abdomen distad, on a varying amount of the pronotal dorsum, the mesonotum and metanotum, and the face, as well as less frequently the pleura

[12] In the lone male known to me the single caudal tibia remaining is appreciably arcuate longitudinally in its distal half. This condition is almost certainly teratological and definite information must await the acquisition of additional male material.

[13] This, I believe, is less than the normal number, and the low figure is probably due to abnormality of this tibia.

[14] Missing.

and the lateral lobes of the pronotum. The cephalic and median limbs of the female are finely mottled with the body tones, the caudal femora largely blackish brown with the external pagina dull buff, the latter having a proximo-median longitudinal fuscous cloud, ventral sulcus of the caudal femora and the caudal tibiae nopal red, the latter proximad clouded with fuscous, the spines cream with black tips. In a few females the caudal femora are less heavily or solidly infuscate dorsad and there show traces of three dull rufescent transverse pale bars, in others there is a weak rufescent wash to the dark dorsum; buff contrast of the paginal area of the caudal femora is more marked in the type and measured paratype than in the other females, in which latter that area grades to as dark and as dully contrasted as snuff brown, while the median darker cloud may or may not be as evident as in the type. The antennae in the females range from mikado brown to dull rufescent, the eyes from tawny-olive to snuff brown, with an intangible cupreous glaze. The ventral surface in the female ranges from sayal brown to orange-cinnamon (type with the latter).

The single male (allotype) has much the same general coloration as the females, but as a whole it has a slightly more contrasted pattern. The face is more grayish, the mouth-parts particularly more clear gray, there is a more evident post-ocular line on the head, the metazona of the pronotum is paler and more buffy than the remainder of the pronotal dorsum, while the proximal abdominal tergite and the general apical section of the abdomen is paler and more buffy than elsewhere. The cephalic and median limbs are more decidedly mottled, the buffy paginal area of the caudal femur is crossed by the continuation from the dorsal surface of two dark bars, these also strongly marked on the internal face of the femur.

Paratypes.—In addition to the type and allotype I have before me six female paratypes bearing the same data as the type. Such noteworthy differences as they show have already been mentioned.

HEBARDACRIS [15] new genus

This genus is also a member of the *Bradynotes* complex, and similarly more nearly related to *Bradynotes* Scudder (genotype *B. obesa* (Thomas)) than to any other genus at present known. It differs chiefly in lacking distinct and appreciably elevated lateral bounding carinae to both the fastigium and frontal costa, as well as having any sulcation of the frontal costa limited to the immediate vicinity of the median ocellus, in the obsolescence of the lateral facial carinae, in the larger and more prominent eyes in both sexes,

[15] In memory of the late Morgan Hebard, who with the present author collected most of the original series of the species on which this genus is erected, and who also described that species.

in the much narrower interocular space in both sexes, in the more produced interantennal section of the facial outline as seen in profile, in the narrower and more constricted pronotum, particularly in the female, in the proportionately less-expanded metanotum, especially in the female, in the male supra-anal plate being scutellate rather than trigonal, and in the absence of definite tympana.

This genus needs comparison solely with *Bradynotes*, and with it represents a distinctive and probably relatively old line of the complex, their specific components limited largely to diverse and often isolated areas, chiefly of boreal or subarctic alpine conditions.

GENOTYPE.—*Hebardacris albida* (Hebard) [*Bradynotes albida* Hebard].[16]

The genus *Hebardacris* represents the most southern known element of the *Bradynotes* complex in the Sierran uplift. It occurs in Hudsonian or Arctic Alpine conditions in areas of broken whitish granite. In the original description of the genotype Hebard published habitat observations made by us at three of the four localities from which the species was originally recorded.

Generic features.—Form as a whole less incrassate in both sexes than in *Bradynotes*; surface, especially in the female sex, with sparse pilosity. Head as in *Bradynotes* somewhat broader across the genae than across the eyes, but this is less evident, particularly in the female sex, than in *Bradynotes*; fastigium less strongly declivent ventro-cephalad than in *Bradynotes*, especially in the male sex, the fastigio-facial angle as seen in profile more evident and more produced than in *Bradynotes*, disk of fastigium but faintly, if at all, excavate, the lateral borders not carinate; least interocular space with breadth distinctly less than the breadth of one of the eyes as seen from dorsum, ranging from half to two-thirds the eye breadth in the male to three-fifths to seven-tenths in the female (in *Bradynotes* always more than eye breadth); frontal costa little evident or obsolete ventrad of median ocellus, with lateral borders non-carinate, surface largely plane with any sulcation limited to the vicinity of the median ocellus; lateral facial carinae obsolete; eyes relatively prominent, particularly in the male sex, and as seen in both dorsal and cephalic aspects, in the female sex more prominent proportionately than usual in melanoploid genera; antennae relatively short, articles individually short. Pronotum short, roughly subquadrate in general outline

[16] Trans. Amer. Entom. Soc., XLVI, p. 361, pl. xvi, figs. 2 and 3 (1920). [♂ (type), ♀ : Lone Pine Lake, Whitney Pass Trail, Sierra Nevada, Mts., Inyo Co., Cal., elev. 10,000-10,100 feet (type locality); East foot of Whitney Pass, Sierra Nevada Mts., Inyo Co., Cal., elev. 12,000-12,500 feet; Mount Gould, Fresno Co., Cal., elev. 12,000 feet.]

as seen from the dorsum, less transverse than in *Bradynotes*, particularly in the female sex, the lateral expansion of the metazonal section of the lateral lobes much less pronounced in the female sex than in that of *Bradynotes*, the greatest pronotal breadth (i. e. across ventro-caudal angles of the lateral lobes) approximating 1.3 times the greatest dorsal length of the pronotum; cephalic margin of pronotal disk virtually entire, not shallowly concavo-emarginate as in *Bradynotes*, caudal margin of same very shallowly concavo-emarginate, metazona in length not exceeding one-third that of the whole pronotal dorsum; three transverse sulci more or less completely indicated on the disk, the second and principal ones intersecting the lateral shoulders and, as well as a well-marked intra-marginal one, present on the lateral lobes; lateral shoulders appreciably evident on the prozona between the intra-marginal sulcus of the lateral lobes and the principal sulcus, not carinate but somewhat strumose, metazona of dorsum rounding into the lateral lobes without intervening carina or shoulder, its surface obscurely impresso-punctulate on both dorsum and lobes; lateral lobes subquadrate in general proportions, both ventral angles rounded obtuse. Mesonotum, metanotum and proximal abdominal tergite in the male sex much as in *Bradynotes*, in the female much less strongly transverse; proximal abdominal tergite laterad without evident tympana (these marked in *Bradynotes*). Furcula in male small but evident (lacking in *Bradynotes*); supra-anal plate of male scutellate, its lateral margins relatively sigmoid, the apex rectangulate, surface with the median more elevated section bearing a sulcation in proximal half, intra-marginal lateral sulci broad; male cerci simple, styliform, tapering as seen in profile, not surpassing apex of supra-anal plate, apices of cerci bluntly rounded as seen in profile and subcompressed as seen from dorsum; subgenital plate of male relatively short and broad, very blunt subrostrate at apex, the latter narrowly separated from the marginal border of the plate; female supra-anal plate trigonal in outline, sulcate mesad in proximal half; cerci of female very short and blunt styliform, hardly, if at all, surpassing the middle of the supra-anal plate, their apices falling short of those of the infra-cercal plates; ovipositor valves of female essentially as in *Bradynotes*; subgenital plate of female with distal margin trigonally produced mesad and without lateral subrectangulate lobes (these present in *Bradynotes*). Prosternal process relatively low but well developed, less elevated and more rounded in the female than in the male sex. Meso-metasternum less broadly deplanate than in *Bradynotes*; mesosternal interspace not quite as broad as (male) or no broader (female) than one of the mesosternal lobes; interspace between the metasternal lobes much narrower than (male) or subequal to (female) the breadth of the interspace between the mesosternal lobes. Cephalic and median femora of essentially the same type as in *Bradynotes*, in the male sex equally robust to those of the latter genus, in the female slightly more slender; caudal femora slightly more slender than those of *Bradynotes*, especially in the male sex; caudal tibiae with 6 to 7 (rarely 8) external and 8 to 9 internal spines; caudal tarsi somewhat more slender than in *Bradynotes*.

Distribution.—High elevations in the neighborhood of Mt. Whitney, in the southern Sierra Nevadas of California. The elevations from which the genus has been recorded range from 10,000 to 12,500 feet.

Remarks.—In addition to the genotypic species (*albida*) this genus includes *Bradynotes excelsa* Rehn, described from Mt. Tyndall, Tulare county, California.[17] The type material of both the included species, as well as representatives of all, and the types or paratypic material of the great majority of the species which have been referred to *Bradynotes*, are now before me, in the collection of the Academy.

Explanation of Figures

Plate IV

Fig. 5.—*Nisquallia olympica* new genus and species. Female (type). Mount Ellinor, Mason County, Washington. Dorsal view. (× 2.)

Fig. 6.—*Nisquallia olympica* new genus and species. Female (type). Mount Ellinor, Mason County, Washington. Lateral view. (× 2.)

Fig. 7.—*Nisquallia olympica* new genus and species. Male (allotype). Mount Ellinor, Mason County, Washington. Cephalic view of head. (Greatly enlarged.)

Fig. 8.—*Nisquallia olympica* new genus and species. Male (allotype). Mount Ellinor, Mason County, Washington. Dorsal view. (× 2.)

Fig. 9.—*Nisquallia olympica* new genus and species. Male (allotype). Mount Ellinor, Mason County, Washington. Lateral view. (× 2.)

Fig. 10.—*Nisquallia olympica* new genus and species. Female (type). Mount Ellinor, Mason County, Washington. Cephalic aspect of head. (Greatly enlarged.)

Fig. 11.—*Nisquallia olympica* new genus and species. Male (allotype). Mount Ellinor, Mason County, Washington. Dorsal aspect of supra-anal plate. (Greatly enlarged.)

[17] Entom. News, XVIII, p. 352 (1907). [♂ (type by subsequent [1912] designation of Rehn and Hebard), ♀; Mt. Tyndall, Tulare Co., California, elev. 12,000 feet.]

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REHN—NEW MELANOPLOID GENERA

ON THE GENUS GESONULA (ORTHOPTERA: ACRIDIDAE: CYRTACANTHACRIDINAE)

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(Plates V and VI)

In the course of revisionary work on the Australian Acridoidea with which I am engaged, the study of various genera which range beyond the limits of Australia, and hence require the consultation of extensive available but unreported series of material from Indo-Malaya, Melanesia and the Oriental Region, has brought to light much constructive information, largely supplementary to that required for the Australian study. It is planned to publish from time to time the more important and comprehensive of these additions to our knowledge of the genera involved. Nothing to be discussed in these studies will anticipate the conclusions to be brought out in the respective parts of the Australian Acridoidea monograph, except in the very few cases where clarity of understanding may make this unavoidable.

The present observations, the second of these resumés, deal with the genus *Gesonula* Uvarov (*Gesonia* Stål, 1861, not *Gesonia* Walker, 1858), a member of the section of the Cyrtacanthacridinae for which Brunner in 1893 [1] used the name Oxyae.

The genus *Gesonia* was erected by Stål in 1878 [2] on the species described by that author, from China, in 1861 as *Oxya punctifrons*. As the generic name *Gesonia* was found preoccupied by *Gesonia* Walker 1858, in Lepidoptera,[3] Uvarov replaced it in 1940 by *Gesonula*.[4]

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[1] Ann. Mus. Civ. Stor. Nat. Genova, XXXIII, p. 136.

[2] Bihang K. Svenska Vetenskaps Akad. Handl., 5, no. 4, p. 47.

[3] List Spec. Lepid. Ins. Brit. Mus., 16, p. 75.

[4] Ann. and Mag. Nat. Hist. (11) 5, p. 14.

A detailed description of the genus has been given by Willemse,[5] and this will be found of service, needing modification only in certain minor details, such as the sculpture of the male supra-anal plate, which is discussed below.

Individuals of the genus are slender in form, macropterous, green in color with dark longitudinal postocular bars reaching from the eyes to the pleura, and in their general facies they closely resemble species of the Neotropical genus *Cornops*, a point originally mentioned by Stål when describing the type species. However, *Cornops* belongs to a phylum which is exclusively Neogaeic, and the similarity of facies is probably due to parallelism reflecting analogous modes of life, both genera being hygrophilous, inhabiting tall grass or similar vegetation growing in or near standing water. Further, both genera, as well as relatives of each, have the extensor surfaces of the caudal tibiae concave, with elevated lamellate lateral borders, a condition also found in other acridoids, such as numerous tetrigids and the members of the cyrtacanthacridine Paulininae, all having the ability to propel themselves through water by using these tibiae as oars. The possession of such an arrangement is thus common to certain assemblages which are not related, and its occurrence cannot be used as a broadly basic or phylogenetic character. Some genera related to *Gesonula*, such as *Oxya*, have similar developments, while others of equal affinity, such as *Bermius*, do not, and doubtless what is found is correlated with the bionomics of the respective genera.

Representatives of *Gesonula* are now known from a relatively broad area of the Oriental, Indo-malayan, Papuan and Australian life areas. The limits of its geographic range, based on published records and material now before me, extend from Ceylon, southern and northeastern India, northern Burma, Szechwan to Chekiang Provinces, China, Ryukyu Islands, Formosa, Philippines, eastern New Guinea, the Solomons, northern Australia (Queensland and Northern Territory), Java and Sumatra. Aside from Ceylon, Formosa and the Ryukyu Islands, representatives from all of these areas are now before me in the Academy collection, to which belongs all the material here discussed unless otherwise stated.

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[5] Tijdschr. Entom., LXXIII, pp. 125-127 (1930).

As to the recorded habits of members of the genus, Tinkham in 1935 notes[6] that in Kwangsi Province, south China, it occurs "in mixed habitats of grass and low vegetation," and in 1940[7] the same author, referring particularly to Kwangtung Province, south China, regarded it as "very secretive and difficult to capture . . . nowhere in abundance but seems to prefer dense shrubbery on the edge of streams at the base of the hills and mountains," and further adds, "it also seems to be fond of mulberry patches, although it does not occur in any number to cause damage." Shiraki[8] reported that his *okinawensis* in Okinawa, Ryukyu, and in Formosa is harmful to rice, and is also found infrequently on sugar cane. In 1933[9] Ramakrishna Ayyar and Krishna Menon published a series of observations on *Gesonula* [as *Gesonia*] *punctifrons* as found at Coimbatore, south India, where it occurred in wet land areas, and particularly on plants of *Colocasia*. Their observations showed that the species oviposited in the succulent stems of that important food plant, the well-known taro. They gave the only descriptive information we have on the five stages of the nymph of this genus. Uvarov later added a number of Solomon Islands records of material taken on *Colocasia*.[10] Miller, in 1934, gave it as occurring in "ricefields and grassland in vicinity" in Selangor.[11]

Certain Colorational Tendencies in the Genus.—There are two well-marked variations in coloration which have no connection with systematic entities, as determined from the basis of two hundred and four specimens of the genus now before me. The evidence of this series indicates that these tendencies are purely individual in character, or correlated with the degree of intensity of pattern—this latter in the case of antennal annulation.

The first of these is the presence of a variable number of dark annulations on each antenna, a feature which apparently caused Navás to use the name *zonocera* for his Mindanao species. We

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[6] Lingnan Sci. Journ., XIV, p. 491.

[7] Lingnan Sci. Journ., XIX, p. 298.

[8] Acrididen Japans, p. 59 (1910).

[9] Journ. Bombay Nat. Hist. Soc., XXXVI, p. 517, plate.

[10] Treubia, 16, p. 16 (1937).

[11] Journ. Feder. Malay States Mus., XVII, p. 526.

find in certain series there is present a range of from a single broad dark preapical annulus to as many as four well-marked but narrow ones in the distal half of each antenna. Very rarely no dark bands are evident. In a series of *punctifrons* from the vicinity of Ledo, Assam, we find a range of from 1 to 3 present in the male sex (the majority with 2), while in the female sex from the same area the range is from 2 to 3 (largely 3). Males of *mundata laosana* from Chieng Mai, north Thailand, show a range from but 1 to 2 (the greater part with but 1), while females from the same locality have a range of from 1 to 4 (a proportionately greater number with but 1). The series of *mundata pulchra* from Batavia and Buitenzorg, Java, have a range from 1 to 3 regardless of sex, while the same is true of the series of *mundata sanguinolenta* from Milne Bay, New Guinea. It is thus clearly evident that the number of dark antennal annuli varies individually in the same population and also that there is no sex correlation in the number present. In no case are the more proximal dark bands as broad as the distal one, which is almost invariably evident and conspicuous.

The base color of the caudal tibiae is glaucous or pinkish red, usually as a solid color, but occasionally the former is in part washed with the latter, or more broadly passing to the latter proximad. Again the glaucous type may be distinctly clouded with fuscous distad. Apparently the control of the base tone here is in accord with what is found in many other species of acridoids which show intraspecifically two base colorations of the caudal tibiae, i.e. that they are individual and may be found in the same population, although occasionally there is a local predominance of one over the other. The evidence of the series of *Gesonula* before me supports fully such a conclusion. Of *G. punctifrons* the representation from the vicinity of Ledo, Assam, has 8 males and 17 females with entirely glaucous caudal tibiae, and 7 males and 6 females with pinkish red ones, 4 females have them glaucous washed distad with pinkish red; of the Shingbwiyang, upper Burma series 3 males and 1 female have the tibiae all glaucous, 1 male with them of the same color washed distad with pinkish red and 1 female with them entirely pinkish red. A Coimbatore, south India, pair have the caudal tibiae glaucous washed proximad with pinkish red, while all seen from Chinese localities have entirely glaucous tibiae, al-

though Stål's type of the species was said to have the caudal tibiae "basi sanguineae."

In the series of the forms of *G. mundata* the caudal tibiae are generally glaucous, but these often show markedly a washing with pinkish red distad or an infuscation in the same area. All Philippine material has glaucous tibiae, although two of three from Siargao Island have them washed with pinkish red distad, and others from four localities show infuscation distad. The relatively extensive representation from Chieng Mai, upper Thailand, has the tibiae glaucous in all, but narrowly, with pinkish red proximad in 3 males and 9 females. All Javanese individuals seen have glaucous tibiae, weakly pinkish red proximad, except for one male ("Java"), which has entirely pinkish red caudal tibiae. A Padang, Sumatra, male also has these tibiae pinkish red, while another from Bah Soemboe, Sumatra, which I studied years ago, and is the type of *Quilta pulchra*, has them glaucous, pinkish red at the base. All New Guinea, Talaut and Solomon Islands material has the caudal tibiae in larger part pinkish red, sometimes briefly glaucous distad, but all have some infuscation at their distal extremity. All Australian material seen has glaucous caudal tibiae, sometimes narrowly pinkish red proximad.

Specific names applied.—The following names have been proposed for units of this genus.[12]

punctifrons (*Acridium* (*Oxya*)) Stål, Kongl. Svenska Freg. Eugenies Resa, Zool. 5, p. 336 (1861).[13] [♂ (not ♀ as stated); China.[14]]

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[12] Kirby (Synon. Catal. Orth., III, p. 393 (1910)), from the evidence of type material, also gives, as based on this genus, Walker's *Heteracris tenuis* (Catal. Derm. Salt. Brit. Mus., IV, p. 668 (1870), [♂; China]), but the four and one-half line description of *tenuis* presents a combination of color features which could not possibly apply to any member of this genus known at this time.

[13] This is stated to be, and is generally cited as, 1860, but Horn and Schenkling (Index Litt. Entom., Ser. 1, III, p. 1175) say 1861 is correct.

[14] The context shows that Stål's use of "♀" for this specimen was an inadvertence, and Sjöstedt in 1920 (Arkiv för Zoologi, 12, no. 20, p. 21) states Stål's type is a male. If taken on the voyage of the Eugenies, as would be supposed, the type undoubtedly came from Hong Kong or the Canton River area of Kwangtung Province, the only areas in China which were visited.

mundata (*Heteracris*) Walker, Catal. Derm. Salt. Brit. Mus., IV, p. 672 (1870). [♂ ; Port Essington [Northern Territory, Australia].]

punctifrons (*Gesonia*) variety *sanguinolenta* Krauss, Denkschr. Medic.-Naturw. Gesell., Jena, VIII, p. 760 (1903). [Halmahera; Amboina, Moluccas; Aru and Key Islands.] [15]

zonocera (*Gesonia*) Navás, Bolet. Soc. Aragon. Cienc. Nat., III, p. 136 (1904). [♂, ♀ ; Agusan, Mindanao, Philippines.]

pulchra (*Quilta*) Rehn, Bull. Amer. Mus. Nat. Hist., XXVI, p. 190 (1909). [♀ ; Bah Soemboe, Sumatra.] [16]

okinawensis (*Racilia*) Shiraki, Acrid. Japans. p. 58 (1910). [♂, ♀ ; Okinawa, Ryukyu Islands; Formosa.] [17]

recticercus (*Gesonia*) Sjöstedt, Arkiv. för Zoologi, 12, no. 20, p. 21 (1920). [♂, ♀ ; Cape York Peninsula, Queensland.]

In 1918 I. Bolívar [18] placed *zonocera* and *sanguinolenta* in synonymy under *punctifrons*, but allowed *pulchra*, which he properly referred to *Gesonula* (as *Gesonia*), to stand as distinct. In 1930 Willemse [19] placed *sanguinolenta*, *pulchra* and *recticercus* as synonyms of *mundata*. Tinkham in 1935 [20] placed *Racilia okinawensis* as a synonym of *punctifrons*, and the same year Sjöstedt [21] accepted the synonymy of his *recticercus* under Walker's much earlier *mundata*. Uvarov in 1937 discussed the nomenclatorial background of Krauss' *sanguinolenta*, and considered it a recognizable entity.[22]

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[15] The use of this name by Brunner (Abhandl. Senckenb. Naturforsch. Gesell., XXIV, p. 198 (1898). [Halmahera]) is merely in a geographic list, no characters are given, and hence it is there a nomen nudum, and the first assignment of any features is in Krauss' 1903 paper.

[16] The proper generic position for *pulchra* was pointed out by I. Bolívar in 1918 (Trab. Mus. Nac. Cienc. Nat., Ser. Zool., no. 34, p. 14).

[17] The proper generic position was given by Tinkham in 1940 (Lingnan Sci. Journ., XIX, p. 297). The latter author, however, erroneously quotes Shiraki's specific name as "*okinawaensis*." Shiraki credited the name to Matsumura, apparently only on the basis of specimen labels. Shiraki's description, which is the actual basis for the name, is not quoted, was clearly written by Shiraki, and hence he is the authority for the name.

[18] Trab. Mus. Nac. Cienc. Nat., Madrid, Ser. Zool., no. 34, p. 14.

[19] Tijdschr. voor Entom., LXXIII, p. 127.

[20] Lingnan Sci. Journ., 14, p. 491.

[21] Kungl. Svenska Vetenskapsakad. Handl., ser. 3, 15, no. 2, p. 71.

[22] Treubia, 16, p. 16.

Specific entities. Two divisions of the genus *Gesonula* can be recognized from the form and sculpture of the supra-anal plate of the male. These I would regard as specific entities. In one the outline of this plate is as a whole more trigonal, while the mediolongitudinal sulcus of its dorsal surface is narrower and continued distad to the apex of the plate, and of subequal breadth except for a weak broadening distad, which, however, does not modify the general pattern of the sulcus. This condition is found in the representatives of the genus seen from all Chinese, Indian and Burmese localities in the series before me. The name *punctifrons* is applicable to this species, and virtual topotypic material has been examined. In the other species the outline of the male supra-anal plate is more nearly scutiform, while the median sulcus as such does not extend more than two-thirds the way to the apex, the surface of the distal third of the plate being more broadly concave-excavate like the bowl of a spoon. This second species is represented by material before me from north Thailand, Sumatra, Java, north Borneo, Philippines, Moluccas, New Guinea, the Solomons, and northern Australia. Walker's name *mundata* was the first applied to any of the geographic elements into which I find this species is divisible.

Key to the Forms of the Genus

1. Supra-anal plate of male subtrigonal in outline, its median sulcus narrower, reaching to the apical section of the plate, of subequal breadth or but slightly widening distad. (See plate VI, fig. 16.) (China, north Burma, India) ..... **punctifrons** (Stål)

   Supra-anal plate of male more scutiform in outline, the median sulcus broader, as such not reaching distad of distal third, the area thence to apex broadly concave-excavate in a spoon-like fashion. (See plate VI, fig. 15) 2

2. Caudal femora with proximal half conspicuously washed with flame scarlet to coral red. (Alar organs relatively long, exceeding apex of abdomen by 1⅓ times the length of the pronotum. Cerci of ♂ virtually straight and not definitely incurved distad as seen from the dorsum.) (New Guinea, Moluccas, Talaut and Solomon Islands.)
   mundata sanguinolenta (Krauss)

   Caudal femora without wash of flame scarlet to coral red 3

3. Cerci of ♂ not incurved distad as seen from dorsum, no indication of a dorsal shoulder on same at distal third. Pronotum somewhat more elongate, in ♂ equal to twice exposed dorsal length of head. (Caudal

femora proportionately more slender. Tegminal apices very narrowly rounded.) (Northern and northeastern Australia.)
mundata mundata (Walker)

Cerci of ♂ appreciably incurved distad as seen from dorsum, usually with a weak indication of a dorsal shoulder near distal third or fourth. Pronotum averaging broader and shorter in ♂, but not quite equal to twice exposed dorsal length of head 4

4. Alar organs relatively longer, surpassing apices of caudal femora by distinctly more than the pronotal length. Fastigium as seen from dorsum more acute produced. Caudal femora proportionately slender and elongate. (North Thailand.) ..... **mundata laosana** new subspecies

Alar organs relatively shorter, surpassing apices of caudal femora by no more, or less, than pronotal length, tegminal apices subacutely rounded. Fastigium as seen from dorsum less acute produced, more rectangulate in outline. Caudal femora proportionately more robust and less attenuate 5

5. Fastigium of ♀ somewhat broader and more blunted as seen from dorsum. Cerci of ♂, as seen in profile, with distal two-fifths rather marked off from proximal portion and more falcately aciculate. (See plate VI, fig. 19.) (Greater Sunda Islands) ..... **mundata pulchra** (Rehn)

Fastigium of ♀ more trigonal in outline as seen from dorsum. Cerci of ♂, as seen in profile, more evenly narrowing distad, not aciculately falcate distad, the depth attenuation there more regular and even. (See plate VI, fig. 18.) (Philippines.) .....**mundata zonocera** (Navás)

Gesonula punctifrons (Stål) Plate V, figs. 1 and 2, pl. VI, fig. 16.

1861. *Acridium* (*Oxya*) *punctifrons* Stål, Kungl. Svenska Freg. Eugenies Resa. Zool., 5, p. 336. [♂ [not ♀]; China.]

All of the male material referable to *punctifrons,* as here outlined, represents a cohesive entity which, at least in the material now available, does not appear to break up into subspecies. I find no clearly marked feature to separate females of this species from those of *G. mundata,* except that in this species the general form is slightly stouter and less strongly attenuate than in females of the components of *mundata.* This is the genotypic species of *Gesonula,* and no one of the other names proposed for the genus was erected on this entity, unless Shiraki's *Racilia okinawensis* from Okinawa and Formosa should prove to be referable to *punctifrons,* a point I cannot determine as I have no material from those areas, and the original description of *okinawensis* is too brief to be of assistance.

The range in size found in this species is here exemplified by the measurements (in millimeters) of the extremes of series, or representatives of other localities, now before me.

	Length of body	Length of pronotum	Length of tegmen	Length of caudal femur
♂, Chekiang Prov., China	17.6	3.5	19.3	11.2
♂, Chengtu, Szechwan Prov., China	20.0	4.0	20.7	11.2
♂, Ledo Road, 1.3 mi. from Ledo, Assam	16.4	3.2	16.3	9.1
♂, Ledo Road, 19 mi. from Ledo, Assam	18.2	3.7	18.7	10.7
♀, Chekiang Prov., China	21.5	4.8	22.0	12.8
♀, Canton, Kwangtung Prov., China	22.0	4.5	22.0	12.2
♀, Chengtu, Szechwan Prov., China	22.9	4.8	24.2	13.0
♀, Ledo Road, 19 mi. from Ledo, Assam	19.5	4.0	18.9	11.2
♀, Ledo Road, 19 mi. from Ledo, Assam	20.3	4.4	21.2	12.2

In distribution, *punctifrons* is known to me to range from Chekiang Province west to Szechwan, China, extreme northern Burma (Shingbwiyang), northeastern Assam (vicinity of Ledo) and southern (Coimbatore) India. Whether the Ceylon record[23] is referable to this species remains for future determination. Presumably the record of *punctifrons* from Hainan[24] was based on correctly referred material.

Material before me clearly referable to *punctifrons* is as follows:[25]

China: Chekiang Province; IV, 24-30, 1925 (E. Suenson); 2♂, 2♀. Mountains near Yenping, Fukien Province; IV, 1, 1920 (H. R. Caldwell); 1♀. Canton, Kwangtung Province; 1921 (C. W. Howard); 1♀. Chengtu, Szechwan Province, one marked "alt. 1700 feet"; X, 2, 1929 and IV, 3, 1940; 1♂, 1♀.

Burma: Shingbwiyang,[26] Hukawng Valley, north Burma; III, 11, V, 28, VI, 3 and 6, 1945 (J. W. H. Rehn); 4♂, 2♀.

India (Assam): Vicinity of Ledo; X, 11-18, 1944 (J. W. H. Rehn); 4♂, 5♀. Vicinity of Tipong Colliery, near Ledo; XI, 26, 1944 (J. W. H.

[23] Krauss, Denkschr. Medic.-Naturw. Gesell., Jena, VIII, p. 760 (1903).

[24] Uvarov, Lingnan Sci. Journ. X, p. 220 (1931).

[25] All of the material listed in this paper is in the collections of the Academy of Natural Sciences of Philadelphia unless otherwise stated.

[26] The position of Shingbwiyang is 26° 43′ N., 96° 13′ E., near the east foot of the Patkai Bum, and about five miles from the Tanai tributary of the Chindwin.

Rehn); 1♀. Ledo Road, 1.3 miles from Ledo; XI, 26-XII, 3, 1944 (J. W. H. Rehn); 3♂, 1♀. Ledo Road, 4 miles from Ledo; VIII, 22, 1944 (J. W. H. Rehn); 1♂. Ledo Road 19 miles from Ledo; X, 19-20, XI, 3-11, 1944 (J. W. H. Rehn); 8♂, 11♀.

India (Madras): Coimbatore; 1930 (P. S. Nathan); 1♂, 1♀.

Gesonula mundata (Walker)

The distinctive character of the sculpture of the supra-anal plate of the male sex of *mundata* has already been discussed, and the figure of the plate here given (plate VI, fig. 15) should prove of service in the recognition of *mundata*.

This species is now known to be divisible into five subspecies, geographic in character but due to the isolation of their individual ranges no clear evidence of intergradation is noticed. However, the intimate relationship of these various entities is clearly indicated, and the relatively minor degree of the differences separating them precludes the use of more than subspecific rank for the same.

As a whole the range of *mundata* is complementary to that of *punctifrons*, being known to me from material continental only in Thailand, elsewhere Indo-Malayan, Papuan and north Australian. I am unable to evaluate properly previous records of the genus from Celebes, Penang, Selangor,[27] and Singapore, but I assume these represented *mundata*, although like those from Formosa, Okinawa, Hainan and Ceylon, here similarly assumed to be *punctifrons*, there is no certainty in these assignments. From material now before me *mundata* is seen to range from Sumatra and north Thailand to the Philippines, eastern New Guinea, the Solomons, and northern Australia (Northern Territory and Queensland).

Gesonula mundata mundata (Walker)

1870. *Heteracris mundata* Walker, Catal. Derm. Salt. Brit. Mus., iv, p. 672. [♂; Port Essington [Northern Territory, Australia].]

1920. *Gesonia recticercus* Sjöstedt, Arkiv för Zoologi, 12, no. 20, p. 21. [♂, ♀; Cape York Peninsula, Queensland.]

The synonymy of *recticercus* under *mundata* was made by Willemse in 1930,[28] and was accepted by Sjöstedt in 1935.[29]

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[27] The record from Sungei Tua, Selangor, by Miller (Journ. Fed. Malay States Mus., xvii, p. 540 (1934)), was definitely credited to *mundata*, but whether in the sense here used I am unable to say.

[28] Tijdschr. voor Entom., lxxiii, p. 127.

[29] Kungl. Svenska Vetenskapsakad. Handl., ser. 3, 15, no. 2, p. 71.

Material of *m. mundata* from both areas of northern Australia from which it had been recorded is now before me. Discussion of this subspecies, together with the data for the material of *m. mundata*, will be presented in the relevant part of the study of Australian Cyrtacanthacridinae now in preparation. The typical subspecies of *mundata* is limited in distribution to northern and northeastern Australia. Published records of *mundata* from Australia are from Port Essington, Brock's Creek and Groote Eylandt, Northern Territory; Cape York Peninsula, Gayndah, Townsville, Rockhampton and Brisbane, Queensland, and "Pine Mountain" of undetermined position.

Gesonula mundata sanguinolenta (Krauss) Plate V, figs. 3 and 4.

1903. *Gesonia punctifrons* variety *sanguinolenta* Krauss, Denkschr. Medic.-Naturw. Gesell., Jena, VIII, p. 760. [Sex?; Halmahera; Amboina, Moluccas; Aru and Key Islands.]

The crediting of this subspecific name to Krauss has been discussed on a preceding page.

The size range (in millimeters) seen in the lots of material before me is as follows:

	Length of body	Length of pronotum	Length of tegmen	Length of caudal femur
♂, Talaut Islands	18.4	3.6	18.0	10.1
♂, Talaut Islands	17.2	3.9	19.2	10.4
♂, Hihilai Plantation, New Guinea	17.1	3.7	18.4	10.7
♂, Hihilai Plantation, New Guinea	20.5	4.0	21.0	11.7
♂, Bougainville, Solomon Islands	17.1	3.9	18.5	10.5
♂, Bougainville, Solomon Islands	17.6	4.0	20.0	11.0
♀, Hihilai Plantation, New Guinea	20.3	4.8	22.9	13.0
♀, Talaut Islands	21.3	4.5	21.8	13.0
♀, Talaut Islands	22.3	4.8	23.4	13.0
♀, Milne Bay, New Guinea	20.8	4.5	22.8	12.7
♀, Milne Bay, New Guinea	23.7	4.8	25.5	12.8
♀, Bougainville, Solomon Islands	20.3	4.5	21.8	11.2
♀, Bougainville, Solomon Islands	21.3	4.8	23.3	13.0

These figures show that while there is but a very limited range in size variation in what may be regarded as several of the more fixed structural features, i.e. pronotal and caudal femoral length, the tegminal length shows a more marked fluctuation in the same population.

Of the various entities within the genus *Gesonula* the present subspecies is the one most readily recognizable in well-preserved material on account of the flame scarlet to coral red suffusion of at least the proximal half of the caudal femora, a condition not seen in any of the other representatives of the genus. In its male cercal structure *m. sanguinolenta* is nearer to *m. mundata* than it is to the other components of the species. The alar organs are definitely elongate, appreciably surpassing in proportionate length those of *m. zonocera* or *m. pulchra,* in this respect more like *m. mundata.*

Previous records of *m. sanguinolenta* were the original ones by Krauss from Halmahera, Amboina, and the Aru and Key Islands, and Uvarov's 1937 records [30] from Guadalcanal (Lavoro), Malaita (Auki), Nggela (Maliali), Shortland (Morgusaia) and Santa Isabel, of the Solomons group. Krauss also mentions Penang as a locality from which he had material with "orangerothe Hinterschenkel." I question the correctness of the latter locality, if the material is so colored, as this seems to be a definitely limited geographic entity. I do not know whether south Celebes and "British New Guinea" records of *punctifrons,* given at the same time by Krauss, relate to this subspecies, but in the latter case I presume they do. Material before me at this time demonstrates the presence of *m. sanguinolenta* in the Milne Bay area and at Fakfak in New Guinea and in the Talaut Islands in the Moluccan Sea between the northeastern point of Celebes and the Philippines, as well as in additional islands (Bougainville and New Georgia) of the Solomons group.

Material examined:

Solomon Islands: Bougainville; II, 1928; 19♂, 17♀ [A. M. N. H. and A. N. S. P.]. Malaita; 1♂, 1♀ [A. M. N. H.]. New Georgia Island; VI, 16, 1928; 1♂, 1♀ [A. M. N. H.].

New Guinea: Milne Bay; II, 12, 1944 (E. R. Helwig); 2♀. Hihilai Plantation, Milne Bay; II, 27 and 28, III, 3, 1944 (E. R. Helwig); 13♂, 2♀. Fakfak; 1♂.

Talaut Islands: 4♂, 3♀.

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[30] Treubia, 16, p. 16.

Gesonula mundata laosana[31] new subspecies

Plate V, figs. 5 and 6; pl. VI, figs. 11-15, 17.

In fastigial form this is probably the most distinctive of the subspecies of *mundata*, and it is the only continental Asiatic form of a species which otherwise is Australian, Papuan and Indo-Malayan. We have no information as to whether this subspecies is present also in south Thailand or in the Malay Peninsula, or whether it is there replaced by the otherwise Indo-Malayan *G. m. pulchra*.

The proportionately longer alar organs of this subspecies, when compared with those of *G. m. zonocera* and *m. pulchra*, suggest *m. sanguinolenta* and *m. mundata*, but the incurving apical portions of the male cerci are nearer what we find in the two former supspecies than in the latter ones. With the relatively acute fastigial form is combined more slender and elongate caudal femora than what we find in *m. zonocera* or *m. pulchra*, the nearest geographic relatives.

Type.— ♂ ; Chieng Mai, north Thailand. January 15-March 1, 1933. (De Schauensee-Sinkler Expedition.) [Academy of Natural Sciences of Philadelphia, Type no. 5770.]

Compared with *Gesonula m. mundata* somewhat smaller in size but very similar in general proportions of parts. Fastigium as seen from dorsum distinctly acute-angulate in outline and produced to a considerable degree, so that the distance cephalad of the least interocular space to the fastigial apex is almost half the normally exposed dorsal length of the head; fastigio-facial angle narrowly rounded acute, somewhat sharper than in the related forms; least interocular space relatively narrow, subequal to half the greatest dorsal breadth of the fastigial disk, facial line straight oblique; eyes as prominent as in *G. m. mundata*. Pronotum slightly broader proportionately than in *m. mundata*. Tegmina surpassing the apices of the caudal femora by a distance appreciably greater than the pronotal length (in the type as 85 to 67), in outline relatively narrow, with the apex rounded subacute, the actual apex on the median axis, and not on the sutural side of the same as in *m. mundata*.[32] Supra-anal plate with its surface sculpture of the *mundata* type discussed in this present paper, and here figured, the distal impressed area broad and cordiform in outline, quite sharply cut off from the much

[31] From the Laos people of northern Thailand.

[32] In the latter subspecies the tegmina have an appreciable "backsweep" toward their apices, which is less evident in *m. laosana* and the other subspecies.

narrower more proximal median sulciform impression; cerci as seen from dorsum appreciably out-bowed in proximal two-thirds, a slight but evident dorsal shoulder present at distal fourth, the internal margin thence to apex virtually straight, viewed in profile the cerci are essentially the same in outline as in *m. mundata*, evenly tapering in proximal three-fourths and thence aciculately and moderately arcuate decurving to the acute apex; subgenital plate essentially as in *m. mundata*. Caudal femora relatively slender, greatest depth contained 4.4 times in greatest femoral length.

Allotype.— ♀ ; same data as type.

Compared with the same sex of *Gesonula m. mundata* the female agrees with the male in being somewhat smaller but otherwise very similar in relative proportions. Fastigium slightly more acute than in the same sex of *m. mundata* but production of fastigium is no greater than in the female of *m. mundata*, the distance from least interocular space to the fastigial apex being little more than two-fifths of the normally exposed dorsal length of head; fastigio-facial angle essentially as in male; eye prominence as in same sex of *m. mundata*. Pronotum as in female of *m. mundata*. Tegmina as in the male, greatly surpassing the caudal femoral apices, this distance being as much as 1.5 times the pronotal length in the allotype (as 115 to 76), their apical outline when compared with that of *m. mundata* as described for the male. Caudal femora relatively slender, but less different in this respect from the femora of the female of *G. m. mundata* than is the case with the male sex, the greatest depth contained 4.8 times in the greatest femoral length.

Representative individuals measure (in millimeters) as follows:

	Length of body	Length of pronotum	Length of tegmen	Length of caudal femur
♂, Chieng Mai, Thailand, *paratype*	16.1	3.4	16.9	9.2
♂, Chieng Mai, Thailand, *type*	16.6	3.6	16.9	10.1
♂, Chieng Mai, Thailand, *paratype*	19.0	3.9	19.0	10.5
♂, Doi Chieng Dao, Thailand, *paratype*	16.7	3.5	17.4	9.9
♀, Chieng Mai, Thailand, *paratype*	19.5	4.0	19.5	10.4
♀, Chieng Mai, Thailand, *allotype*	19.7	4.0	20.2	11.2
♀, Chieng Mai, Thailand, *paratype*	20.7 [33]	4.4	21.8	12.7
♀, Doi Chieng Dao, Thailand, *paratype*	20.3	4.2	21.0	11.4
♀, Doi Chieng Dao, Thailand, *paratype*	21.2 [33]	4.5	22.4	12.2

[33] This is under true body length, as the abdomen has been deflexed ventrad when drying.

Coloration.—Material of *G. m. laosana* has a color pattern of the same type as is found in all the other members of the genus, which has been described by several previous authors and is well shown in the accompanying illustrations of this subspecies. Both yellowish-green and brownish color phases are present in the series of *G. m. laosana* before me, the former by a much larger number of individuals than the latter. Whether this represents a population ratio or merely one of collecting incidence cannot be determined. Both the type and allotype represent the yellowish-green phase.

Variation.—The considerable series of this form before me shows that there is some little variation in the exact degree of the fastigial outline angle as seen from the dorsum, but the description presents what is found in the greater part of the material of both sexes now before me. An occasional specimen has the angulation nearer a right angle, but on the other counts, i.e. tegminal length, caudal femoral proportions, and, if a male, cercal details, the identity of the individual is fully evident.

Paratypes.—All material examined other than the type and allotype is regarded as paratypic.

Specimens examined:

THAILAND: Chieng Mai; I, 15-III, 1, 1933 (de Schauensee-Sinkler Exped.); 17 ♂ (*type* and *paratypes*); 15 ♀ (*allotype* and *paratypes*). Doi Chieng Dao (Mt. Chung Doi), elev. 4000 ft.; I, 7-21, 1933 (de Schauensee-Sinkler Exped.); 2 ♂ (*paratypes*): elev. 3500 ft.; III, 18, 1928 (R. M. de Schauensee); 4 ♀ (*paratypes*).

Gesonula mundata zonocera (Navás)

Plate V, figs. 7 and 8, pl. VI, fig. 18.

1904. *Gesonia zonocera* Navás, Bolet. Soc. Aragon. Cienc. Nat., III, p. 136. [♂, ♀; Agusan, Mindanao, Philippines.]

The original description of *zonocera* gives no feature which is diagnostic of this subspecies. The character of antennal annulation, which gave rise to the name, has already been discussed in this paper, and the condition described by Navás is shared with other representatives of the genus and is in no way peculiar to *m. zonocera*. The relationship of *m. zonocera* and *m. pulchra* is very close and to my mind they are more closely related than are the other subspecies of *mundata* to one another. On purely biotic

grounds this is as would be expected. Both agree in having the alar organs relatively short when compared with the other subspecies of *mundata*, and from *m. laosana* the present race and *m. pulchra* are also distinguishable by the proportionately less acute and more rectangulate fastigial outline, as seen from the dorsum, and the more robust and less attenuate caudal femora.

Representative material measures (in millimeters) as follows:

	Length of body	Length of pronotum	Length of tegmen	Length of caudal femur
♂, Lubuagan, Luzon, Philippines	14.6	3.4	15.6	9.4
♂, Polillo Islands, Philippines	17.9	3.9	16.9	10.1
♂, Dulag, Leyte Philippines	16.3	3.9	16.3	10.4
♂, Siargao Island Philippines	17.4	3.7	17.2	10.1
♂, Siargao Island Philippines	16.6	3.5	16.3	9.7
♀, Manila, Luzon, Philippines	21.0	4.7	21.8	13.0
♀, Los Baños, Luzon, Philippines	21.1	4.4	19.8	12.3
♀, Siargao Island, Philippines	21.1	4.7	19.2	12.5
♀, Taloon Trail, Santa Cruz Mts., Davao Prov., Mindanao, Philippines	21.0	4.7	20.8	12.0

None of the representations of this subspecies before me are large enough to judge what the extent of size range may be in an individual population. However, in all material of *m. zonocera* seen there is less range in individual proportions than would be expected in even such a small series, representing as it does five separate islands. The small size of the Lubuagan male, and that of another male from Muñoz, Nueva Ecija Province, may be a response to more montane conditions in northern and central Luzon.

The material before me shows reasonably well-marked green and brown phases in general coloration. Both are represented in the three Los Baños females.

This Philippine subspecies was originally described from Agusan, Mindanao, after having been recorded from the "Philippines" by Krauss as *punctifrons*. Bruner in 1915,[34] reported

[34] Univ. Studies Univ. Nebr., 15, p. 61 (1915).

punctifrons as doubtfully occurring in the Philippines, *zonocera* only from its type locality, and a named but undescribed species from Paeta, in Laguna Province, Luzon and Maao, Occidental Negros. The material now examined shows this form ranges over at least much of the Philippine Archipelago, being before me specifically from Luzon, Polillo, Leyte, Siargao and Mindanao.

Material examined:

PHILIPPINES: Lubuagan, Kalinga Subprovince, Luzon; I, 26, 1912 (W. Boettcher); 1 ♂. Muñoz, Nueva Ecija Province, Luzon; XII, 20, 1933 (G. A. Pangga); 1 ♂. Manila, Luzon; XI, 4, 1914 (W. Boettcher); 1 ♀. Los Baños, Laguna Province, Luzon; IV, 1915; 1 ♀ (C. J. Banks); 1 ♀: (Baker); 1 ♀. Polillo Island (Baker); 1 ♂. Dulag, Leyte; XII, 3, 1944 (E. R. Helwig); 2 ♂. Lagolago, Baybay, Leyte; II, 20, 1945 (E. R. Helwig); 1 ♂. Siargao Island (W. Boettcher); 2 ♂, 1 ♀. Davao, Mindanao (Baker); 1 ♀. Taloon Trail, Santa Cruz Mts., Davao Province, Mindanao, elev. 3000-5000 ft.; IX, 13, 1930 (C. F. Clegg); 1 ♀.

Gesonula mundata pulchra (Rehn)

Plate V, figs. 9 and 10, pl. VI, fig. 19.

1909. *Quilta pulchra* Rehn, Bull. Amer. Mus. Nat. Hist., XXVI, p. 190. [♀; Bah Soemboe, Sumatra.]

When this form was described no other material of the present genus was then available, and it was erroneously referred to the related but quite distinct genus *Quilta*, a matter rectified by Ignacio Bolivar in 1918,[35] who then gave the proper generic position. Bolivar's assignment was subsequently confirmed by the present author's reexamination of the type in the American Museum of Natural History.

This subspecies is probably broadly distributed over the greater Sunda Islands, and perhaps even beyond, as past records of *punctifrons* from Singapore (Krauss, 1902) and south Celebes (same author) may refer to this subspecies. Material is now before me from Sumatra, Java and north Borneo. From the latter area, however, I have seen only a single female which had been dried from alcohol, and its relationship is—on both counts—less conclusive than might otherwise be the case.

The Sundan (*m. pulchra*) and Philippine (*m. zonocera*) subspecies are exceedingly close, but are recognizable entities when

[35] Trab. Mus. Nac. Cienc. Naturales, Madrid, Ser. Zool., no. 34, p. 14.

well-preserved material is compared. It is evident that the two have had a recent common origin, and the more intimate relationship of *m. zonocera* and *m. pulchra,* rather than the former with *m. sanguinolenta,* would indicate more emphasis on a Luzon-Bornean relationship than a Mindanao-Moluccan one.

Previous records of *punctifrons* which probably refer to this subspecies are those from Padang, Fort de Kock, Medan and Sungei Rampah, Sumatra (Willemse, 1930), Garoet (Willemse, 1934) and Satteburg (I. Bolívar, 1918), Java and Borneo (Krauss, 1902).

All of the material seen is greenish-yellow to olive-yellow in tone, none being truly in a brown phase.

Representative specimens measure (in millimeters) as follows:

	Length of body	Length of pronotum	Length of tegmen	Length of caudal femur
♂, Padang, Sumatra	16.3	3.5	15.9	10.2
♂, Batavia, Java	16.9	3.9	16.4	10.2
♂, Batavia, Java	17.9	3.9	18.2	10.4
♂, Buitenzorg, Java	15.8	3.5	16.3	9.4
♂, Buitenzorg, Java	18.0	3.4	16.9	9.6
♀, Bah Soemboe, Sumatra, *type*	21.0	4.7	20.0	12.0
♀, Batavia, Java	21.2	4.5	20.3	11.5
♀, Batavia, Java	19.2	4.4	20.7	12.5
♀, Buitenzorg, Java	20.3	4.2	17.7	10.9
♀, Buitenzorg, Java	22.8	5.2	21.0	12.7

The above figures show that the range of size within the subspecies is not great, and that the extremes may be found within individual populations.

Material examined:

Sumatra: Padang; XII, 17; 1 ♂.

Java: (no exact loc.); 1 ♀.[36] Batavia; VIII, 22-29, XI, 21, 1920 (Karny); 3 ♂, 5 ♀; [A. N. S. P. and Buitenzorg Mus.] Buitenzorg; VIII, 5 and 15, IX, 2, 1920; 7 ♂, 10 ♀ [A. N. S. P. and Buitenzorg Mus.].

Borneo: Mohari; 1912 (N. Borneo Exped.); 1 ♀.

Possible History

There can be little doubt but that *Gesonula* is of mainland Asiatic derivation, and that the two specific lines we find in the

[36] Determined and labelled by I. Bolívar as "*punctifrons.*"

genus differentiated in southeastern Asia. Of these, *punctifrons* apparently spread widely to the eastward and southwestward, yet retained its basic features, and has not divided into geographic races, even under conditions as diverse as those of south India and of Chekiang Province, eastern China. On the other hand, *mundata*, the basic or more primitive stock of which was probably that here called *m. laosana*, of northern Thailand, exhibits definite segregation into geographically limited subspecies. It would seem that the *mundata* stock, at an undetermined time, pushed southeastward over the Sunda arc, and established itself in northern Australia and New Guinea, which regions were, in the Glacial Period at least, broadly connected by the then-exposed Sahul shelf, which occupied much of the present area of the shallow Arafura Sea, in addition to closing the present Torres Strait.[37] The relatively close relationship of the Thailand *m. laosana*, the Australian *m. mundata*, and the Papuan and Moluccan *m. sanguinolenta* suggests this possibility. The subsequent segregation of the Philippines and the elements of the Greater Sunda Islands (which latter developed from the Sunda shelf) apparently allowed modifying forces to produce in these areas the very closely allied *m. pulchra*, of the Greater Sunda Islands, and *m. zonocera*, of the Philippines. These, following the pattern of more rapid evolution in multinsular areas, known to be true of many animals and plants, are probably very recent developments. Conversely *m. mundata*, which has a relatively great and continental area of distribution, like *G. punctifrons*, shows no tendency toward further subdivision.

Thus it would seem that *m. mundata* and *m. laosana*, the geographic extremes of the *mundata* line, are the oldest of its elements, that *m. sanguinolenta* is a more recent development, with the paired *m. pulchra* and *m. zonocera* the youngest of the components. The worth of such an hypothesis can be weighed more critically only when we know more definitely what the relationship may be of *Gesonula* material from Celebes, from the Malay Peninsula, and from elements of the Lesser Sunda group, none of which is at present available to the author.

[37] See Keble, "Notes on Australian Quaternary Climates and Migration" (Mem. Nat. Mus. Victoria, 15, figs. 10 and 12 (1947)). Also see Molengraaff (Geogr. Journal, LVII, pp. 95-121 (1921) and particularly his accompanying chart), and Dickerson, "Distribution of Life in the Philippines," pl. 40 (1928).

Explanation of Figures

Plate V

Fastigia as seen from dorsum (much enlarged)

Fig. 1.—*Gesonula punctifrons* (Stål). Male. Chekiang Province, China.
Fig. 2.—*Gesonula punctifrons* (Stål). Female. Canton, China.
Fig. 3.—*Gesonula mundata sanguinolenta* (Krauss). Male. Hihilai Plantation, Milne Bay, New Guinea.
Fig. 4.—*Gesonula mundata sanguinolenta* (Krauss). Female. Same locality as fig. 3.
Fig. 5.—*Gesonula mundata laosana* new subspecies. Male (type). Chieng Mai, Thailand.
Fig. 6.—*Gesonula mundata laosana* new subspecies. Female (allotype). Same locality as fig. 5.
Fig. 7.—*Gesonula mundata zonocera* (Navás). Male. Dulag, Leyte, Philippines.
Fig. 8.—*Gesonula mundata zonocera* (Navás). Female. Taloon Trail, Mindanao, Philippines.
Fig. 9.—*Gesonula mundata pulchra* (Rehn). Male. Buitenzorg, Java.
Fig. 10.—*Gesonula mundata pulchra* (Rehn). Female. Batavia, Java.

Plate VI

Fig. 11.—*Gesonula mundata laosana* new subspecies. Male (type). Chieng Mai, Thailand. Lateral view. (X 2.)
Fig. 12.—*Gesonula mundata laosana* new subspecies. Male (type). Chieng Mai, Thailand. Dorsal view. (X 2.)
Fig. 13.—*Gesonula mundata laosana* new subspecies. Female (allotype). Chieng Mai, Thailand. Lateral view. (X 2.)
Fig. 14.—*Gesonula mundata laosana* new subspecies. Female (allotype). Chieng Mai, Thailand. Dorsal view. (X 2.)
Fig. 15.—*Gesonula mundata laosana* new subspecies. Male (paratype). Chieng Mai, Thailand. Dorsal view of supra-anal plate. (Greatly enlarged.)
Fig. 16.—*Gesonula punctifrons* (Stål). Male. Chekiang Province, China. Dorsal view of supra-anal plate. (Greatly enlarged.)
Fig. 17.—*Gesonula mundata laosana* new subspecies. Male (type). Chieng Mai, Thailand. Lateral outline of cercus. (Greatly enlarged.)
Fig. 18.—*Gesonula mundata zonocera* (Navás). Male. Siargao Island, Philippines. Lateral outline of cercus. (Greatly enlarged.)
Fig. 19.—*Gesonula mundata pulchra* (Rehn). Male. Padang, Sumatra. Lateral outline of cercus. (Greatly enlarged.)

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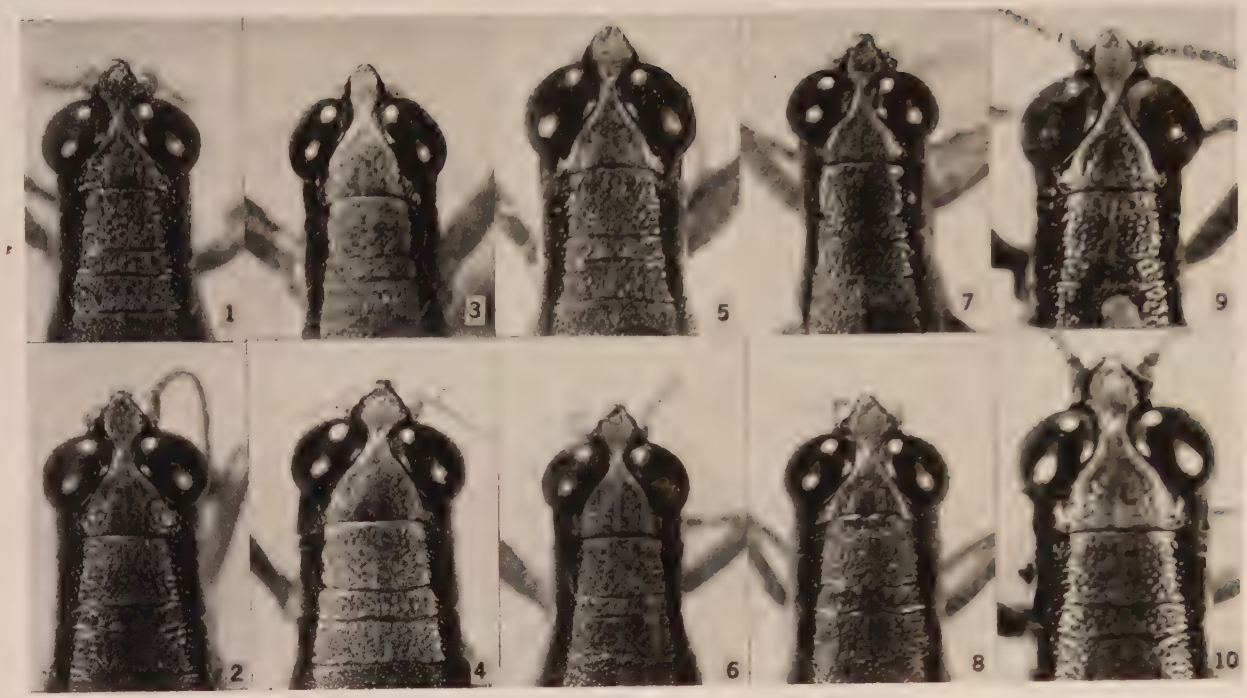
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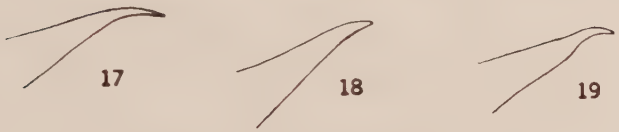

REHN—THE GENUS GESONULA

A REMARKABLE NEW SPECIES AND SUBGENUS OF CHRYSID WASP FROM NORTH AMERICA, WITH NOTES ON RELATED FORMS. (HYMENOPTERA: CHRYSIDIDAE)

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At Princeton, New Jersey, and again near Albany, New York, an astonishing little chrysid was discovered that has four occipital tubercles or knobs crowning its head, bringing to mind two species originally named *Chrysis faceta* Aaron and *C. quadrituberculata* Cameron. So far as I am aware, these are the only described species of *Chrysis* that have a tuberculate vertex. Interestingly enough, and perhaps an indication of their common evolutionary origins, the apical margins of their third abdominal tergites are in a general way similar to each other, representing what appear to be increasingly extreme modifications of the medially emarginate apical lamina of the male of the new species described below.

The scalloping and dentation of the apical margin of the third abdominal tergite is today almost universally used to break the enormously populous genus *Chrysis* into some nine subgenera. Perhaps emphasis on these patterns often simplifies to a marked degree the actual labor of identification of these always difficult wasps, but there is no doubt that such emphasis taxonomically juxtaposes many species that are clearly unrelated, possessing as they do outstanding contrasts and incongruities in other characters. Consider, for example, the problem of subgeneric allotment of *Chrysis tenuicornis* Taylor that so perplexed Taylor,[1] and which

[1] Taylor, L. H. 1924. Chrysididae from Lower California. Proc. Cal. Acad. Sci., 4th series, vol. 13: 325-332.

may still be regarded as an open question. I propose, therefore, to group together the species that have a tuberculate vertex in a common subgenus of *Chrysis*. Such a taxonomic assignment to a new subgenus will, I believe, do the least violence to our current subgeneric divisions, for a literal following of subgeneric keys would actually place the female of the new species in *Chrysura* Dahlbom (or *Olochrysis* Lichtenstein), the male in *Gonochrysis* Lichtenstein, the male of *Chrysis faceta* Aaron in *Gonochrysis* or *Dichrysis* Lichtenstein depending on the degree of lateral sinuation at the margins of the median notch, and males and females of *C. quadrituberculata* Cameron in *Dichrysis*.

The purpose of this paper, then, is to describe this new subgeneric division of *Chrysis* and its type species, and to amplify the original descriptions of *Chrysis faceta* and *C. quadrituberculata* so that the principal morphological distinctions among these three presumably related species can be made clear.

Ceratochrysis *subgen. nov.*

Ceratochrysis includes those species of *Chrysis*, as now constituted, that have a quadrituberculate vertex, *i. e.*, a raised boss or knob lying on the vertex behind each lateral ocellus and each compound eye. Maxilla and tongue not markedly elongated; mandibles with a strong subapical tooth; first discoidal cell of forewing closed and appendiculate, the enclosing cubital, discoidal and first recurrent veins being well developed; second discoidal cell open at its posterior distal angle; radial cell open, veins obsolescent at tip.

GENOTYPE: *Chrysis* (*Ceratochrysis*) *enhuycki* sp. nov.

Both sexes of *Chrysis enhuycki* sp. nov., and *C. quadrituberculata* Cameron are available for study. Males and females in each of these species closely agree in their own specific morphology, despite the remarkable fact that in *C. enhuycki* there is a striking sexual dimorphism of the apical margin of the third abdominal tergite. Only two males of *C. faceta* Aaron are known to me, but it is likely that they too are similar to individuals of the female sex of that species. For this reason I believe that the following key, based on structural characters, will satisfactorily allow recognition of both sexes of *C. faceta*, although the tufts of hair on the meso- and metatibia in that species may ultimately prove to be an attribute of males only.

Key to the species of Ceratochrysis

1. Clypeus with a conspicuous, polished, impunctate, crescentic apical lip; postocular tubercles of vertex much longer than broad; tubercles polished; malar space equal to length of second antennal joint; head as long as pronotum behind the anterior pronotal inflection; body slender, about 3.4-3.5 × greatest width of second abdominal tergite (New Jersey, New York) ..... **Chrysis (Ceratochrysis) enhuycki** ***sp. nov.***

   Clypeus without a polished, crescentic, apical lip; postocular tubercles about as broad as long; tubercles coriaceous; malar space but half the length of the second antennal joint; head considerably longer (1.6-2 ×) than dorsal pronotal shelf; body more robust, not more than 3.1 × greatest width of second abdominal tergite 2

2. From in front, head about 1.3 × as broad as high; from above, head about 1.6 × length of dorsal pronotal shelf; scutellum, postscutellum and median space of propodeal enclosure very roughly and coarsely punctured; posterior border of postscutellum poorly marked medially; meso- and metatibia without inner, apical brush of longer hairs; third abdominal tergite of both sexes with a prominent projecting tooth to each side of median notch; large, 7.9-9.0 mm. body length (Guatemala, Texas)
   Chrysis (Ceratochrysis) quadrituberculata Cameron

   Head about 1.5 × as broad as high; twice as long as pronotal shelf; punctation more regular and less coarse over scutellum, postscutellum and median space of propodeal enclosure; posterior border of postscutellum well marked and conspicuous throughout its length; meso- and metatibia with a conspicuous apical brush of hairs on inner apical thirds and fourths, respectively; third abdominal tergite (in male, at least) with a conspicuous, angular median notch, but no lateral, projecting teeth; small, 4.5-5.9 mm. body length (Colorado, Texas)
   Chrysis (Ceratochrysis) faceta Aaron

Four specimens of the new species had been taken at Princeton, New Jersey, in the interval 1940-1946, but—in the absence of any similar forms in the extensive collections of the United States National Museum, the Academy of Natural Sciences of Philadelphia, the Museum of Comparative Zoölogy at Harvard University, or in the experience of others—it had seemed to me possible that somehow an exotic had been accidentally but successfully introduced in the vicinity of Princeton. The capture, however, of a specimen of this species near Albany, New York, during a survey of the wasp fauna of the Edmund Niles Huyck Preserve (at Rensselaerville, Albany County, New York) and its environs, removed virtually all doubt from my mind that the species is in fact a native one. With a considerable sense of pleasure I give it

the name "*enhuycki*" as a tribute to Edmund Niles Huyck, to whose memory the Preserve and its biological research are dedicated. This new species may be described as follows.

Chrysis (Ceratochrysis) enhuycki sp. nov. Figs. 3, 5, 6, 8, 9.

Male and female dimorphic.

Female.—Length 6.1-7.3 mm. Head: Seen face on, nearly 1.3 × as broad as height from vertex to clypeal apex; vertex high, flattened; head above slightly broader than pronotum, equally as long as pronotum from anterior humeral margin to mesoscutum. Vertex quadrituberculate; one tubercle behind and slightly medial to each lateral ocellus, one behind superior orbital angle of each eye. Postocellar tubercles roughly hemispherical, but postocular tubercles fully twice as long as broad, their long axes converging behind. Ocellar triangle strongly raised, with ocelli nearly perpendicular to surrounding vertex. Ocellar-ocular distance approximately equal to distance between posterior ocelli. Face on, postocular tubercles just visible, but elevated ocellar triangle conceals postocellar tubercles. Transverse facial carina slightly bowed forward, extending across two-thirds of front at its level. Adoral lateral extension of facial carina bends strongly downward toward eye, nearly reaching inner orbital margin, making angle of 50°-60°; aboral lateral extension of transverse carina sharply reflexes upward, weakly continuing posteriorly nearly to enclose median ocellus. Area of face bounded by facial carina, inner orbits and clypeus roughly square. Facial basin shallow; finely, transversely striated only at narrow, median longitudinal depression, coarsely punctate elsewhere. Clypeus subequal in length to diameter of antennal fossa, with a small median nubbin just below antennal fossae; a polished, crescentic area over slight median emargination. Mandible with strongly developed subapical tooth. Posterior orbit separated from occiput by well-defined carina extending from mandibular base to upper postorbital third, or beyond. Malar space as long as second antennal joint. Approximate relative lengths of first four antennal joints (not including articular bases): I/3, II/1, III/1.6, IV/0.8.

Thorax.—Prehumeral slope (between true anterior margin and humeral margin) of pronotum perpendicular, or nearly so. Raised, posterior, dorsal shelf-like portion of pronotum as long as scutellum along mid-line; short, depressed medial line on anterior half; declivous face nearly straight; sides sinuate, nearly parallel in anterior two-thirds. Four deep pits along juncture of anterior pronotal shelf with declivous face. Mesoscutum twice as broad as long; notaulices strongly impressed, parallel to apical third, thereafter gradually, arcuately divergent; parapsidal lines weak, on posterior two-thirds only. Mesopleural suture and median episternal groove well-marked by coarse punctures; upper episternal plate sharply demarcated; lower mesepisternal plate poorly marked off from mesepimerum. Postscutellum somewhat more than half the length of scutellum; both convex. Posterior lateral projections of propodeum divergent, each with a prominent, rounded, obtuse

anterior angle and acute posterior angle. Metapleural spine acute apically, projecting directly posteriorly; stubby, reaching to less than mid point of propodeal spine. U-shaped groove of propodeum broad, marked laterally by shallow, more or less confluent foveae.

Abdomen.—Convex; relative lengths of tergites: I/1, II/1.5, III/1+. First tergite concave in anterior third, with a broad shallow depression in middle third; posterior margin shallowly arched forward; posterior lateral corners rounded, slightly obtuse. Second tergite along median line 1.6–1.8 × the length of its lateral margin; with a faint, median carina; posterior lateral angles obtuse; hind margin thickened, slightly arched posteriorly. Third tergite (figs. 6, 9) from above convex in marginal outline; broadly, transversely depressed medially; submarginal foveate groove extends nearly to base of segment. Pits deep, often confluent, not accurately countable, 11–14 per side. Apical lamina gently sinuate at sides, margined by a delicate groove that may or may not be obsolescent medially; free edge of lamina not iridescent but translucent brown and membranous.

Legs.—Few noteworthy features. Hind leg with uniform brush of short, fine hairs along bowed posterior surface of tibia; tibia subequal in length to hind tarsus; first tarsal joint slightly shorter than remaining four combined.

Wings.—Forewing 4.2–4.7 mm. long; subdiscoidal vein obsolescent at juncture with second discoidal cell.

Punctation.—Close on head, punctures of varied sizes, largest more than half an ocellus in diameter. Tubercles of vertex smooth, with sparsely scattered punctures, finer and fewer on the postocellar bosses. Punctures of varied diameters on thoracic dorsum, less close and larger than those of head on the average; interstices finely and sparsely punctured. Punctures smaller on abdominal tergites, becoming increasingly small and more dense posteriorly; interstices sparsely punctured. Punctures confluent on third tergite; very close, small, and disorderly below transverse impression, producing a more or less roughened surface to the bulge forming the anterior rim of the submarginal, foveate sulcus. Apical lamina of third tergite shining; sparsely, finely punctured in the type, closely and rugosely punctured in the other female.

Color.—Green with strong reflections that are brassy (especially on face), bluish (especially first and second tergites), or bluish-purple (on pronotum, mesoscutum, scutellum, postscutellum, and propodeum). Postocellar tubercles shining black; postocular tubercles iridescent, greenish and purple. Tarsi brown. Wing veins brown, membrane hyaline; amber-brown tinge suffusing radial, cubital, discoidal and, variably, the median cell. Hind wings hyaline; faint amber delineation of radial vein; slight brown tinge of membrane along radial edge.

Pubescence.—Erect, pale whitish-brown, sparse; longer (an ocellus-diameter or greater) on vertex and thorax than on abdomen. Longest on scutellum of all thoracic regions. Pubescence of face, underside of body, and legs, white. Hairs sparse and suberect on facial quadrangle; scattered, long white hairs of genal margins of occiput exceeding two ocellus-diameters in length.

Male.—Length 6.1-7.1 mm. Differs but little from the female, except in the form of the apical lamina of the third abdominal tergite.

Facial area a proportionately higher rectangle (fig. 3b); tubercles as in female (fig. 3a).

Dorsal, posterior, raised pronotal shelf subequal or equal to scutellar length along midline; sides of this portion of pronotum convergent anteriorly.

Third abdominal tergite (figs. 5, 8) from above convex in marginal outline, but divided apically by a broad, relatively shallow, median notch; margins of notch convex outwards. Viewed endwise, ultimate angle of apical notch from 90° to more than 100°. Third tergite with a slight, transverse depression medially. As in female, submarginal foveate groove extends nearly to base of segment; pits are deep, often confluent, not accurately countable, 9-14 per side. Apical lamina bisinuate at sides, completely margined by a narrow groove (figs. 5, 8); edge of tergite membranous.

Forewing 4.3-4.8 mm. long.

Apical lamina of third tergite moderately finely, somewhat rugosely, punctate.

Pubescence much as in female, except along orbital thirds of facial quadrangle; hairs here more dense, more decumbent, arranged regularly, sweeping down inner orbits to form conspicuous patches best seen obliquely from above.

Basiparamere (fig. 5p) apically biemarginate in dorsal outline, the inner, smaller emagination forming a deep notch approximately a third the length of the total incision.

Type.— ♀ ; Princeton, New Jersey, June 23, 1946 [U. S. National Museum.] *Allotype.*— ♂ ; Princeton, N. J., June 23, 1946 [U. S. National Museum.] *Paratypes.*— ♀ ; Princeton, N. J., September 15, 1946.— ♂ ; Princeton, N. J., July 28, 1940 [Academy of Natural Sciences of Philadelphia.]— ♂ ; Lawsons Lake, 1.5 miles south of Tarrytown, Albany County, New York, July 21, 1951. All specimens collected by author.

Chrysis (Ceratochrysis) quadrituberculata Cameron

Chrysis quadri-tuberculata Cameron, 1888, Biol. Centr.-Amer., Hymenoptera, vol. 1, p. 461, pl. 20, figs. 7, 7a.

Chrysis (Olochrysis) quadri-tuberculata Mocsáry, 1889, Monogr. Chrysid., p. 211, pl. 2, fig. 8.

Chrysis (Dichrysis) quadrituberculata Bischoff, 1913, Gen. Insect., fasc. 151, p. 45, pl. 5, fig. 37.

Chrysis (Dichrysis) quadrituberculata Bodenstein, 1951, Hym. N. A., U.S.D.A. Agr. Mon., no. 2, p. 722.

Three specimens of this species are at hand, all previously identified by Wm. G. Bodenstein. One is a female from the collection of Karl V. Krombein, bearing the labels: Dimmit County, Texas, July 29, 1934; on purple Pull peas, S. E. Jones Collector; 6307. Two others, both males from the collection of the University of Kansas, are from Hidalgo County, Texas, July 28, 1928, A. M. James Collector; July 30, 1928, R. H. Beamer Collector. The three specimens are strikingly similar, and agree quite well with Cameron's original description and figures.[2] Supplementary to Cameron's account, the following comparison with *Chrysis enhuycki* will be helpful in better defining the wasp. Characters not mentioned here, but described under *C. enhuycki*, are similar in the two species.

Male and female closely similar. Length, ♀ 9 mm.; ♂ 7.9-8.4 mm.

Head.—As in *C. enhuycki*, head viewed face on (fig. 2b) approximately 1.3 × as broad as high; from above, about 1.6 × length of dorsal pronotal shelf. Tubercles not visible in face view in female, but all four just visible in both males. Postocellar and postocular tubercles roughly hemispherical (fig. 2a). Ocellar triangle not so strongly raised as in *C. enhuycki*; ocellar-ocular distance but two-thirds postocellar distance. Transverse facial carina slightly bowed backward, extending across more than three-fourths of front at its level before giving off lateral extensions. Adoral lateral extension short, bending slightly downward in female specimen, but more abruptly so in both males. Aboral extensions arise nearly perpendicularly from transverse carina; nearly completely enclose median ocellus. Facial area much higher than wide; ratio of height of vertex-clypeal apex to interorbital width from 1.4-1.5 +. Facial basin deep, a band along longitudinal, median third or more, strongly, transversely striated; moderately finely, closely, rugosely punctate at sides. Clypeus markedly less in length than diameter of antennal fossa; slightly emarginate or nearly truncate; punctured finely throughout; without a median, polished, apical lip. Malar space but half as long as second antennal joint. Relative lengths of first four antennal joints: I/3, II/1, III/2 +, IV/1 ±.

Thorax.—Prehumeral slope of pronotum strongly oblique, somewhat rounded dorsally; posterior pronotal shelf slightly shorter than scutellum; sides of pronotum sinuate, slightly convergent anteriorly. Mesoscutum approximately 1.8 × as broad as long; notaulices diverge at anterior fifth.

[2] Mocsáry's and Bischoff's figures are inaccurate copies of Cameron's fig. 7a, giving quite erroneous impressions of the apex of the third abdominal tergite. It ought also be noted that Cameron describes the teeth, or lobes as he terms them, as shining and impunctate. The specimens that I have studied have scattered punctures on the apical teeth or lobes, just as elsewhere on the apical lamina, and agree in this respect with Cameron's fig. 7a.

Median episternal groove well marked; mesopleural suture strongly delineated in both males, but weakly so in the female. Posterior lateral projection of propodeum divergent, acute; anterior angle obtuse, not rounded, closer to body than in *C. enhuycki*. Lateral sulci of propodeal U-shaped area shallow, without definite inner boundaries.

Abdomen.—Relative lengths of abdominal tergites: I/1, II/1.5-1.6, III/1 +. Second tergite with a strong median carina; its dorsal length approximately twice its lateral edge. Third tergite (figs. 7, 11) has its regularly curved margin broken medially by a notch of 90°, more or less; to each side of notch a prominent, bluntly pointed, projecting tooth. Third tergite has a weak carina medially, is slightly depressed to each side of midline below middle. Submarginal foveate groove extends nearly to base of segment; pits very deep, frequently confluent, not accurately countable, 6-10 per side. Apical lamina (fig. 11) straight in lateral profile, but sinuate on side just before origin of apical tooth; margined by a shallow, narrow groove; extreme edge piceous.

Wings.—Forewing about 5.4-5.8 mm. long. Subdiscoidal vein more strongly developed than in *C. enhuycki*, in the female at least joining discoidal vein.

Punctation.—Tubercles obscurely coriaceous, with few, fine, scattered punctures over surface. Submarginal lamina of third tergite polished, sparsely pocked by small punctures.

Color.—Deep blue and green, with brassy reflections in facial basin (more so in female). Tubercles dark, somewhat iridescent in female and one male; in other male they appear to have not attained imaginal coloration, are light tan, only very faintly iridescent, despite fact that the specimen as a whole is obviously not teneral. No suggestion of the length of the radial vein in hind wing, as there is in *C. enhuycki*.

Pubescence.—Whitish; in both sexes hairs of orbital thirds of facial quadrangle decumbent, dense, forming conspicuous lateral silvery patches best viewed obliquely from above.

Basiparamere (fig. 7p) apically biemarginate in dorsal outline; smaller, inner emargination only about one-sixth depth of total incision.

Chrysis (Ceratochrysis) faceta Aaron

Chrysis faceta Aaron, 1885, Amer. Ent. Soc. Trans., vol. 12, p. 229, ♀ (?).
Chrysis (*Gonochrysis*) *faceta* Mocsáry, 1889, Monogr. Chrysid., p. 303, ♀ (?).
Chrysis (*Gonochrysis*) *faceta* Bischoff, 1913, Gen. Insect., fasc. 151, p. 43.
Chrysis (*Chrysogona*) *faceta* Bodenstein, 1951, Hym. N. A., U.S.D.A. Agr. Mon., no. 2, p. 722, ♂.

The only specimens of *Chrysis faceta* Aaron that are known to me are the type from Colorado (Type # 4951 in the Academy of Natural Sciences of Philadelphia), and a specimen in the U. S. National Museum, bearing a mount of the phallus, labelled:

San Diego, Texas; 25-4; Coll. W. H. Ashmead; *Chrysis* (*Gonochrysis*) *facetа* Aaron, ♀; *Chrysis faceta* Aaron, verified [L. H.] Taylor 1928, ♂. Both are males agreeing reasonably well in most characters and with Aaron's description. To the latter may be added the following supplementary account of diagnostic attributes, uniform with the two preceding descriptions.

Male.—Length 4.5-5.9 mm. Head: Face on, head nearly 1.5 × as broad as high (fig. 1b); from above, twice as long as pronotum from humeral margin to mesoscutum. Postocellar and postocular tubercles roughly hemispherical (fig. 1a). Ocellar-ocular distance slightly less than postocellar distance. Transverse facial carina straight; adoral lateral extensions bend sharply down and out, meeting inner orbital line at about 70°; aboral extensions nearly perpendicular to transverse facial carina, well marked to level of median ocellus or beyond. Facial area approximately 1.3 × as high as broad, longitudinal medial-half or more transversely striated, remainder closely and finely punctate to inner orbits. Clypeus less than diameter of antennal fossa in length; punctured over surface, no polished lip at apex; barely emarginate. Malar space half the length of second antennal joint. Relative lengths of first four antennal joints: I/3, II/1, III/2, IV/1.

Thorax.—Prehumeral slope of pronotum oblique, not perpendicular; posterior pronotal shelf only 0.7 length of scutellum along mid-line; sides convergent anteriorly, deeply sinuate. Mesopleural suture and median episternal groove poorly marked. Posterior lateral projections of propodeum divergent, spine-like, acute; anterior angle small, not broadly rounded. Lateral sulci of propodeal U-shaped area shallow, without definite medial boundaries.

Abdomen.—Relative lengths of abdominal tergites: I/1, II/1.7, III/1. Second tergite with median carina in anterior two thirds; its dorsal length twice its lateral margin. Third tergite (fig. 4) with sides more straight and convergent apically; divided medially by a notch of 80°-90°, approximately half as deep as broad; with a median carina; transversely depressed medially. Submarginal foveate groove extending nearly to base of segment; pits well marked, deep medially, often confluent, not accurately countable, 7-12 per side. Apical lamina broadly sinuate at sides (fig. 10); margined by a delicate groove.

Punctation.—On whole, closely set. Tubercles of vertex not polished; uniformly and minutely coriaceous—like pebbled leather; with few, very fine, microscopic punctures. Punctures of third abdominal tergite not markedly confluent, nor especially close, small, or disorderly below transverse impression. Relatively short marginal lamina of third tergite with few, scattered, small punctures.

Color.—Head and thorax bright blue and green, in striking contrast to brilliant, golden-cupreous abdomen. Tubercles of vertex iridescent. Wing membrane hyaline; slightly infuscated on radial cell. Radial vein of hind wing barely indicated.

Pubescence.—Erect; whitish; everywhere proportionately longer than in the other two species of *Ceratochrysis.* Hairs of orbital quarters of facial basin dense, decumbent, forming striking lateral patches. Meso- and metatibia with conspicuous, projecting, apical brushes of hairs on their inner apical thirds and fourths respectively; some hairs of brushes exceed 2.5 ocellus-diameters.

Basiparameres (fig. 4p) with an apical Y-shaped indentation in dorsal outline; the vertical limb of the "Y" as long as half the depth of the emargination in the uncompressed phallus.

Other than minor variations in coloration, the principal differences between the type and the U. S. National Museum specimen lie primarily in characters of the head. The facial basin is shallower in the type, and the sides of the transversely striated area are markedly convergent adorally, with the striations continuing nearly to the antennal fossae. The aboral lateral extensions of the facial carine nearly surround the median ocellus in the type, and the occipital carina along the gena is poorly marked. In the Texas male, however, the facial basin is deeper, the transversely striated area has nearly parallel side margins, and merges with a hairy, punctate strip just above the antennal fossae, the aboral lateral carinae reach only as far as the median ocellus, and, as usual, the occipital carina extends to the upper post-orbital third. These differences are probably individual rather than specific, but a final decision on this score must await the assembly of a fair series of specimens.

Compare now the three species. *Chrysis enhuycki* and *C. faceta* are similar to each other, and unlike *C. quadrituberculata,* in very few basic features indeed. Their chief common distinctive character seems to be the apical dorsal outline of the basiparamere in the male (fig. 4p *cf.* 5p). On the other hand, *C. enhuycki* and *C. quadrituberculata* are similar to each other, and unlike *C. faceta,* in their less broad heads as seen from before, their well-marked mesopleural sutures, their not spine-like propodeal projections, and the simple pubescence of their meso- and metatibia. Interestingly, *C. quadrituberculata* and *C. faceta* exhibit many correspondences and are more closely similar to each other morphologically than either is to *C. enhuycki.* Thus they are robust forms with a head length considerably longer than the pronotal length. Postocellar and postocular tubercles are not dissimilar in form, and are

coriaceous. The clypeus is without an impunctate polished, conspicuous lip, the malar space is short, the third antennal joint twice the length of the second, the dorsal length of the second abdominal tergite twice that of its lateral margin, and so on.

Yet each of the three species has unique and distinctive morphologic attributes, and the differences between them are solely quantitative. The sexual dimorphism of the third abdominal tergite and bearding of the facial basin, the polished, impunctate clypeal lip, the polished tubercles of two different shapes on the vertex, the long malar space, and the distinctive basiparamere, at once sets *Chrysis enhayeki* apart from the others. The deeply notched lamina of the third abdominal tergite, with its projecting lateral teeth, as well as the slight inner emargination of the basiparamere, distinguishes *C. quadrituberculata*. *C. faceta* is easily recognized not only by its brilliant cupreous abdomen, but as well by its meso- and metatibial brushes, its simple angular notching of the third tergital lamina and, of course, by the distinctive basiparamere. While one day it may prove that the relative paucity of material has simplified the distinctions that may be drawn, and that characterization will grow more difficult as more specimens and new forms come to light, certainly at the present time there is no group of *Chrysis* in North America where the species are so readily recognizable as in *Ceratochrysis*.

Acknowledgment.—Many thanks are extended to R. H. Beamer of the University of Kansas, W. G. Bodenstein of Crownsville, Maryland, Karl V. Krombein of the U. S. National Museum, and to James A. G. Rehn of the Academy of Natural Sciences of Philadelphia, for the privilege of studying specimens in their custody.

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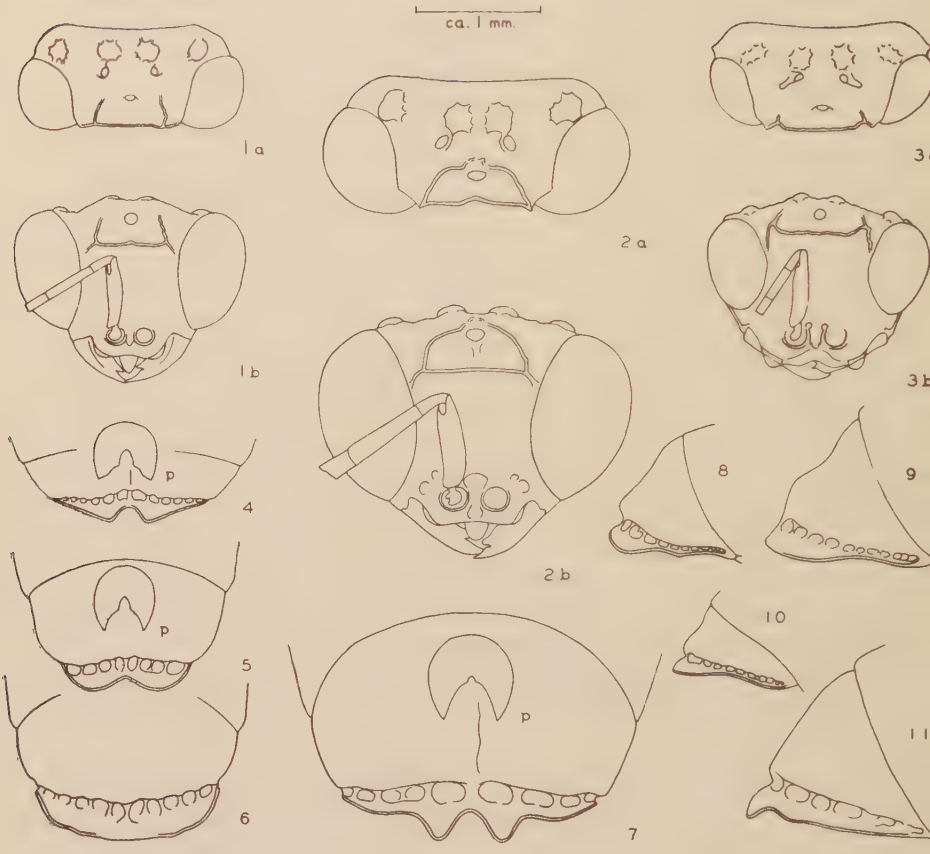

Fig. 1, *Chrysis faceta* Aaron, head of ♂; a, vertex; b, face. Fig. 2, *Chrysis quadrituberculata* Cameron, head of ♂; a, vertex; b, face. Fig. 3, *Chrysis enhuycki* sp. nov., head of ♂; a, vertex; b, face. Fig. 4, *C. faceta* ♂, third abdominal tergite and basiparamere (p). Fig. 5, *C. enhuycki* ♂, third abdominal tergite and basiparamere (p). Fig. 6, *C. enhuycki* ♀, third abdominal tergite. Fig. 7, *C. quadrituberculata* ♂, third abdominal tergite and basiparamere (p). Fig. 8, *C. enhuycki* ♂, lateral view of third tergite. Fig. 9, *C. enhuycki* ♀, lateral view of third tergite. Fig. 10, *C. faceta* ♂, lateral view of third tergite. Fig. 11, *C. quadrituberculata* ♂, lateral view of third tergite.

Note.—Views of the face (figs. 1b, 2b, 3b) are drawn somewhat obliquely from above so that all four tubercles of the vertex may be represented. The third abdominal tergite (figs. 4-7) has been drawn as viewed from a point perpendicular to the mid-dorsal surface of the tergite. All drawings are free hand.

THE LYCIDAE OF THE UNITED STATES AND CANADA. V. PLATEROS

(COLEOPTERA)

BY JOHN WAGENER GREEN

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Plateros is a large genus of small or medium sized lycids widely distributed in North and South America, and extending across southern Asia and the islands of the Pacific to New Guinea. A few species are recorded from Africa, none from Europe. Most of the Nearctic representatives are uniformly similar in structure and color, having the body black and the pronotum fulvous with a median dark spot. Published descriptions of these mutually similar forms consist largely of useless verbiage, for apparently external diagnostic characters of any value do not exist. Fortunately the remarkably diversified male genitalia supply a positive means of specific segregation. The females of all but a few of our species cannot be identified unless taken in copulation. Sufficient material of this kind is not now available, so the present investigation is of necessity restricted almost entirely to a study of the males.

In all the American Lycidae, differing thereby from the eastern Cladophorini and related tribes, the lobes of the aedeagus arise distally from a suboval basal piece, the dorsal surface of which is membraneous and the ventral surface partly or entirely sclerotized. *Plateros* is unique in the American fauna in lacking the lateral lobes, a formation noted also in the oriental genus *Macrolycus*. Some American species of *Lycus* (*Neolycus*) show a tendency in this direction by a partial anchylosis between the reduced lateral lobes and the median lobe. This probably represents an early stage in the eventual absorption of the former by the latter, while the completed process may be seen in a slight swelling that occurs at or near the base of the median lobe in many *Plateros* species.

It is regrettable that so many of the previously published names of Nearctic *Plateros* must remain for the present in the list of unknown species. These are all species of which the original descriptions offer no clues to their identity, and whose type specimens either (a) are destroyed or otherwise inaccessible, or (b) are females and therefore unidentifiable.

To the authorities of the following institutions the author acknowledges with sincere appreciation the loan of valuable material received subsequent to the publication of Part I of this series: Agricultural and Mechanical College of Texas; Ohio State Museum; San Diego Natural History Museum; United States National Museum; University of Michigan Museum of Zoology; and the Entomological Laboratory at Augusta, Maine. In the same category is a fine collection received from Owen Bryant. Invaluable contributions were made by Ross H. Arnett, W. S. Brown, J. Balfour-Browne, and P. J. Darlington, by fixing the identity of certain species through comparison with the types, usually involving extraction of the genitalia; and by Melville S. Hatch through the loan of type material. The author is especially indebted to Dr. Darlington for permission to study the Leconte, Fall, and Melsheimer types, and to make genitalic dissections when no other method of specific diagnosis could be found.

PLATEROS Bourgeois

1879. *Plateros* Bourgeois, Ann. Soc. Ent. Belg., XIX, p. 19.
1915. *Neoceletes* Leng and Shoemaker, Jour. N. Y. Ent. Soc., XXIII, p. 56.

Form elongate, subparallel, slightly wider posteriorly. Antennae simple, slender, narrowly separated at base, over half as long as the body in the male; second joint small, about as long as wide; third broader, subtriangular, longer than second; joints 4 to 10 elongate, subequal, each longer than third, gradually more slender distally; vestiture inclined, usually more or less erect and bristling in the male. Front short before the eyes, strongly deflexed, mouth nearly vertical; mandibles small, arcuate, briefly overlapping when closed; clypeus free, transverse, feebly or not emarginate. Palpi similar in the sexes, slender, gradually broader to apex; terminal maxillary longer than wide, its sides feebly diverging from base, rarely subparallel, its apex oblique and subequal to inner side; terminal labial similar to maxillary, usually somewhat broader and more distinctly triangular.

Pronotum transverse, subpentagonal, widest at base, anterior angles rounded, rarely obliterated, lateral margins subparallel or diverging posteriorly, posterior angles acute and usually somewhat prominent laterally; sides,

apex, and base reflexed, the sides more broadly; disk without carinae, median longitudinal line channeled at base, sometimes more or less carinate at apex. Scutellum usually not emarginate, impressed at apex.

Elytra about five times as long as pronotum and conjointly at apical third about one-third wider; each with ten rows of subquadrate and irregular cells, the four discal costae variable, usually slightly more elevated than the intercostae, sometimes rather prominently so; vestiture short, not dense, evenly distributed. Anterior coxae contiguous, middle coxae rather narrowly separated. Legs normal, trochanters short, tibiae nearly straight, unmodified at apex, the spurs very small. Abdominal sternite 8 of male with a broad arcuate apical emargination; aedeagus without lateral lobes.

Key to Nearctic Species

1. Pronotum entirely fulvous 2
   Pronotum not entirely fulvous 6
2. Scutellum fulvous 3
   Scutellum black 13
3. Terminal segment of abdomen fulvous ..... (2) **arizonensis** new species
   Abdomen entirely black 4
4. Habitat Lower California: aedeagus asymmetric dorso-ventrally (1) **sanguinicollis** Horn
   Habitat Arizona; aedeagus bilaterally symmetrical dorso-ventrally 5
5. Aedeagus as in Figure 3; deflexed and sinuate in lateral aspect (3) **tumacacori** new species
   Aedeagus as in Figure 4; straight in lateral aspect (4) **knulli** new species
6. Pronotum entirely black; habitat Arizona, New Mexico, and Colorado 7
   Pronotum normally fulvous with a median black spot, occasionally entirely black in color variations occurring in the Appalachian Mts. ..8
7. Aedeagus as in Figure 5 ..... (5) **nigerrimus** Schaeffer
   Aedeagus as in Figure 6 ..... (6) **nigrior** new species
8. Aedeagus distinctly asymmetric in dorso-ventral outline 9
   Aedeagus not notably asymmetric in dorso-ventral oultine 16
9. Abdominal sternite 9 with apical angles abruptly produced posteriorly (7) **bidens** new species
   Abdominal sternite 9 not as above, apex rounded 10
10. Median lobe of aedeagus arcuately ascending, flattened and somewhat expanded medially on left side, margin of expanded part minutely and sparsely serrulate ..... (8) **lictor** Newman
    Median lobe not as above 11
11. Median lobe horizontally expanded at tip, the expanded part broader than long with its lateral angles acuminate and directed basally (9) **batillifer** new species
    Median lobe not as above 12
12. Habitat Arizona, New Mexico, and Colorado 13
    Habitat eastern and mid-western states 14

13. Aedeagus as in Figure 10; pronotum usually semi-elliptic, with or without a median black spot ..... (10) **coccinicollis** Fall
Aedeagus as in Figure 11; pronotum usually subpentagonal, with median dark spot ..... (1) **roseimargo** Fall
14. Median lobe of aedeagus straight or nearly so, asymmetrically auriculate beyond the middle of its length ..... (12) **sollicitus** Leconte
Median lobe twisted distally, not auriculate 15
15. Median lobe with a sub-basal prominence ..... (13) **floralis** Melsheimer
Median lobe simple in basal half .... (14) **subtortus** new species
16. Median lobe arcuately ascending, with a small submedian membraneous area on the right side 17
Median lobe not as above, membraneous area, when evident, ventral ... 18
17. Aedeagus as in Figure 15 ..... (15) **flavoscutellatus** Blatchley
Aedeagus as in Figure 16 ..... (16) **peregrinus** new species
18. Median lobe slender basally, enlarged distally, base of enlargement more or less auriculate each side 19
Median lobe not as above, without auriculate projections 23
19. Median lobe in profile appearing somewhat like the head of a bird, auriculae prominent 20
Median lobe in profile appearing somewhat like the head of a snake, auriculae small 22
20. Eyes large, separated medially above by less than their length; elytral pubescence longer than usual ..... (17) **ocularis** new species
Eyes smaller, separated by more than their length; elytral pubescence normal 21
21. Aedeagus as in Figure 18 ..... (18) **volatus** new species
Aedeagus as in Figure 19 ..... (19) **avians** new species
22. Aedeagus as in Figure 20, long and slender .. (20) **capillaris** new species
Aedeagus as in Figure 21 ..... (21) **timidus** Leconte
23. Aedeagus as in Figure 22, with a large subapical process extending downward from the ventral surface. Body comparatively broad and of larger size; discal costae of elytra rather prominent, (22) **modestus** Say
Aedeagus not as above; elytral costae feebly or not elevated 24
24. Median lobe in profile arcuately ascending at tip, its upper margin not sinuate 25
Median lobe in profile with its upper margin sinuate, or arcuately descending at tip 28
25. Median lobe slender, terminating in a subconical cap which is sharply limited basally by a distinct collar ..... (23) **capitatus** new species
Median lobe not as above 26
26. Median lobe slender, very slightly enlarged subapically, tip briefly divided, as viewed dorso-ventrally ..... (24) **subfurcatus** new species
Median lobe not as above 27

27. Median lobe nearly straight, slender, terminating in a rounded knob with a small spiculate process extending each side, as viewed dorso-ventrally (25) **bispiculatus** new species
Median lobe stouter, horizontally expanding distally, then narrowing to apex ..... (26) **perditus** new species
28. Distal part of median lobe vertically compressed beneath 29
Median lobe not as above 30
29. Aedeagus as in Figure 27, tip of median lobe abruptly narrowed, as viewed dorso-ventrally ..... (27) **transpictus** new species
Aedeagus as in Figure 28, tip of median lobe gradually narrowing, as viewed dorso-ventrally ..... (28) **devians** new species
30. Distal part of median lobe horizontally expanded (29) **centralis** new species
Median lobe not as above 31
31. Median lobe longitudinally carinate beneath toward base (30) **carinulatus** new species
Median lobe not as above 32
32. Aedeagus as in Figure 31 ..... (31) **borealis** new species
Aedeagus as in Figure 32 ..... (32) **australis** new species

Unknown Species of Nearctic Plateros

aeger Leconte (*Eros*), Jour. Acad. Nat. Sci. Phila., 2nd ser., I, 1847, p. 80. Type, and only specimen, a female.

alatus Newman (*Eros*), Ent. Mag., V, 1838, p. 382. Type, and only specimen, a female.

canaliculatus Say (*Lycus*), Boston Jour. Nat. Hist., I, 1835, p. 154. Type destroyed.

lascivus Leconte (*Eros*), Jour. Acad. Nat. Sci. Phila., 2nd ser., I, 1847, p. 83. Type, and only specimen, a female.

marginellus Fabricius (*Lycus*), Syst. Eleuth., II, 1801, p. 118. Type unavailable.

minutus Leconte (*Eros*), Jour. Acad. Nat. Sci. Phila., 2nd ser., I, 1847, p. 82. Type, and only specimen, a female.

mollis Leconte (*Eros*), Jour. Acad. Nat. Sci. Phila., 2nd ser., I, 1847, p. 83. Type, and only specimen, a female.

nanus Melsheimer (*Dictyopterus*), Proc. Acad. Nat. Sci. Phila., II, 1845, p. 302. Type, and only specimen, lacks abdomen.

socius Leconte (*Eros*), Jour. Acad. Nat. Sci. Phila., 2nd ser., I, 1847, p. 81. Type, and only specimen, a female.

vilis Leconte (*Eros*), Jour. Acad. Nat. Sci. Phila., 2nd ser., I, 1847, p. 83. Type not in Leconte collection, probably destroyed.

The descriptions that follow apply to males only, and are restricted to a brief outline of coloration, and to the few external features that show some appreciable interspecific diversity. All the external characters mentioned are more or less variable, and are entirely inadequate for identification. The genitalic drawings are therefore to be considered as the essential part of each description. The general form of the body, from narrowly elongate to comparatively broad, is indicated by the ratio of length to width, the latter measurement taken at the widest part and corrected for any spreading of the elytra that usually occurs in dry specimens. Similarly, the size of the eyes is indicated by their distance apart, the size varying inversely to the degree of separation.

The sequence of species, as they are here presented, is of no phylogenetic significance. The first four species constitute a natural group, agreeing among themselves in external characteristics, yet differing widely in genitalic structure. They occur in the Upper Sonoran life zones of Arizona, and in Lower California. With several exceptions the remaining species are equally as divergent among themselves in the formation of the genitalia. That the processes of evolution have all but ceased to function for the Nearctic species of *Plateros* surviving today is indicated by the lack of any noteworthy variability in their genitalia, and by the absence of any complexes of closely related or feebly differentiated species. It is unlikely that the Nearctic fauna is completely represented in this study. Intensive collecting along the southern borders of the United States, from Florida to Arizona, is almost certain to result in the discovery of new forms.

(1) **Plateros sanguinicollis** Horn (Fig. 1.)

1894. *Plateros sanguinicollis* Horn, Proc. Calif. Acad. Sci., ser. 2, IV, p. 379.

Black; prothorax above and beneath, scutellum, and underside of mesothorax, fulvous; head black or dark brown; legs entirely black, the front and middle coxae sometimes fulvous. Form elongate, subparallel, length-width ratio about 3.2:1; elytral costae feebly elevated; antennae slender, vestiture long and erect; eyes rather large, separated medially above by about one and one-fourth times their length; palpi slender, terminal joint of maxillary nearly parallel-sided. Length 4-5 mm.

Distribution.—Lower California: Los Animas, Sierra Laguna, X–12; San Pedro, X–7; Tudos Santos, X–10; Sierra San Lazaro; Sierra El Chinche.

The identity of this species was confirmed by examination of the genitalia of the type, located in the collection of the California Academy of Sciences. Three males and a female in the same collection, and the male cotype from the Horn collection at the Academy of Natural Sciences of Philadelphia, seem to be at present the only other known representatives of the species. Specimens collected in Arizona, practically identical in appearance with *sanguinicollis*, belong to the three following species.

(2) **Plateros arizonensis** new species (Fig. 2.)

Black; prothorax above and beneath, scutellum, ninth abdominal segment, and underside of mesothorax, fulvous; head fulvous or reddish brown; first two antennal joints fulvous, sometimes darker above; legs, including coxae, fulvous basally, the anterior pair most extensively, the posterior pair largely black. Form elongate, subparallel, length-width ratio about 3.2:1; elytral costae feebly elevated; antennae slender, the vestiture long and erect; eyes large, separated medially above by a little more than their length; maxillary palpi slender, terminal joint nearly parallel-sided. Length 4-4.75 mm.

Holotype.—Male; Santa Catalina Mts., Arizona, Peppersauce Canyon, VIII–13–40, collected by J. J. Du Bois; located in collection of California Academy of Sciences.

Paratypes.—9 males in collections of: Amer. Mus. Nat. Hist. (1); Calif. Acad. Sci. (1); Illinois Nat. Hist. Survey (5); Ohio State Univ. (2).

Distribution.—ARIZONA: Santa Catalina Mts., Peppersauce Can., VIII–13; Mt. Lemmon, VIII–2; Tucson Mts., VIII–1; Tucson, VII–24, VIII–14; Patagonia, VIII–20; Superior, VIII–5.

This species closely resembles *P. sanguinicollis*, differing in its distinctive genitalia and in the fulvous ninth abdominal segment. Only males have been seen, so it is not known if the abdominal color character holds for the opposite sex.

(3) **Plateros tumacacori** new species (Fig. 3.)

Color nearly as in *arizonensis*, the head and ninth abdominal segment black, basal joint of antennae black, the second and third joints more or less fulvous, especially beneath. Form and external structure as in *arizonensis*, differing from that species in its distinctive genitalia. Length 4.5-5 mm.

Holotype.—Male; Tumacacori Mts., Arizona, VIII–7–50, collected by D. J. and J. N. Knull; located in Ohio State University collection.

Paratypes.—5 males in collections of: Calif. Acad. Sci. (2); Ohio State Univ. (3).

Distribution.—ARIZONA: Tumacacori Mts. VIII–7; Yanks' Spring, Bear Valley, Tumacacori Mts., VIII–3.

(4) **Plateros knulli** new species (Fig. 4.)

Color nearly as in *arizonensis*, the head and ninth abdominal segment black, basal joint of antennae black, the second and third joints black or partly brownish, legs only briefly fulvous basally, the posterior pair black. Form and external structure as in *arizonensis*, differing from that species in its distinctive genitalia. Length 3.75-4.5 mm.

Holotype.—Male; Sabino Canyon, Arizona, VII–30–50, collected by D. J. and J. N. Knull; located in Ohio State University collection.

Paratypes.—21 males in collections of: Amer. Mus. Nat. Hist. (2); Calif. Acad. Sci. (11); Ohio State Univ. (7); F. H. Parker (1).

Distribution.—ARIZONA: Sabino Canyon, VII–30; Mt. Lemmon, VIII–2; Chiricahua Mts., VII–26; Chiricahua Mts., 3.5 mi. w. of Portal, VIII–13; Patagonia, VIII–1; Tucson, VII–21; Baboquivari Mts., Kits Peak, 4050 ft., VIII–1; Huachuca Mts., VIII–12 & 19; Huachuca Mts., Carr Canyon, 4500 ft., VIII–8; Globe, VIII–10.

Females from a series of both sexes taken by the author at Carr Canyon in the Huachuca Mts. are colored as in the males, differing therefrom, as is usual, in their smaller eyes, shorter and stouter antennae with the vestiture not erect, and larger average size. Length 4.5–5.25 mm.

(5) **Plateros nigerrimus** Schaeffer (Fig. 5.)

1908. *Plateros nigerrimus* Schaeffer, Jour. N. Y. Ent. Soc., XVI, p. 63.

Entirely black. Form elongate, length-width ratio about 2.8:1; elytral costae scarcely elevated; antennal vestiture suberect; eyes small, separated medially above by about one and three-fourths times their length. Length 5.5-6.5 mm.

Distribution.—ARIZONA: Catalina Mts., VII–28; Santa Rita Mts., VII–4 to VIII–13; Pinal Mts., VII–24 to VIII–23; Huachuca Mts., VI–14 to VIII–5; Huachuca Mts., Carr Canyon, 4500 ft., VIII–8; Tumacacori Mts., VIII–7; Patagonia, VIII–22; Prescott, VII–29; Mt. Washington, Nogales, 6000 ft., VII–17; Williams, VIII–2; Chiricahua Mts., VI–14 to VII–14.

This species so closely resembles the following one, *P. nigrior*, that it cannot be identified with certainty unless the genitalia are examined. Dr. Ross H. Arnett made this examination of the five males in Shaeffer's series of *nigerrimus* at the National Museum, and found that they all agreed with Figure 5. He has designated one of these males the lectotype, U.S.N.M. type number 42354.

(6) **Plateros nigrior** new species (Fig. 6.)

Entirely black. Form elongate, length-width ratio about 3.0:1; elytral costae scarcely elevated; antennal vestiture suberect; eyes rather small, separated medially above by about one and three-fifths times their length. Length 6.5-8 mm.

Holotype.—Male: Waldo Canyon, Colorado, VI–25–16, collected by W. D. Edmonston; located in U. S. National Museum collection.

Paratypes.—10 males in collections of: Calif. Acad. Sci. (6); Ohio State Univ. (3); F. H. Parker (1).

Distribution.—Colorado: Waldo Canyon, VI–25. New Mexico: Porvenir. Arizona: Huachuca Mts., Carr Canyon, VII–7; White Mts., VII–10; Pinaleno Mts., VI–27; Chiricahua Mts., VI–27, VII–27; Williams, VIII–2 & 9.

This species averages a little larger than *nigerrimus*, is somewhat more elongate, and has slightly larger eyes. These differences are, however, too insignificant and variable to serve as identifying characters. The genitalia of the two species are of the same general structure but differ consistently from each other in many respects, the most conspicuous being the form of the distal portion of the median lobe beyond the lateral auriculate processes. In *nigrior* this part is short and parallel-sided in dorso-ventral aspect, and arcuate in profile. In *nigerrimus* it is longer and more slender, narrowing toward base, and straight or nearly so in profile.

(7) **Plateros bidens** new species (Fig. 7.)

Black; pronotum fulvous with a longitudinal black spot in median two-thirds or more, broadly attaining base but not apex. Form less elongate, length-width ratio about 2.5:1; elytral pubescence shorter and denser than normal, the discal costae scarcely elevated; antennal vestiture not erect; eyes small, separated medially above by about one and three-fourths times their length; abdominal sternite 8 with a shallow angulate emargination at apex; sternite 9 broad, widest at tip, the apical angles each produced in a subtriangular projection longer than wide, the two projections somewhat

diverging posteriorly, the apical margin transverse between them. Length 7.5-8.25 mm.

Holotype.—Male; Carrizo, Arizona, V–28–48, collected by D. J. and J. N. Knull; located in Ohio State University collection.

Paratype.—Male; Miller Canyon, Huachuca Mts., Arizona, VII–20, collected by H. A. Wenzel; in Ohio State University collection.

The broad and deep emargination of abdominal sternite 9, caused by the abrupt extension of the apical angles, renders this the most easily identified of all the Nearctic species of *Plateros*.

(8) **Plateros lictor** (Newman) (Fig. 8.)

1838. *Eros lictor* Newman, Ent. Mag., v, p. 382.
1915. *Neoceletes crateracollis* Leng and Shoemaker, Jour. N. Y. Ent. Soc., XXIII, p. 56.
1918. *Plateros californicus* Van Dyke, Bull. Brook. Ent. Soc., XIII, p. 1.
1929. *Plateros columbiensis* Brown, Can. Ent., LXI, p. 108.

Black; pronotum fulvous with a longitudinal black spot in median three-fifths, more or less, broadly attaining base but often not reaching apex, rarely the pronotum is almost entirely black; examples from the extreme southern part of its range sometimes have the pronotal spot much reduced, leaving broad lateral and apical fulvous borders, and a narrow basal one; legs and usually the elytra entirely black, the humeral callus very rarely fulvous. Form elongate, length-width ratio about 2.8:1; elytral costae scarcely elevated; antennae slender, vestiture erect; eyes large, separated medially above by a little less than their length. Length 3.5-8.25 mm.

Distribution.—MAINE: Mt. Katahdin, VI–25; Bar Harbor, VI–30; Endfield, VI–12; Paris, VII–4 & 12; Greenville, VII–22. NEW HAMPSHIRE: Center Harbor, VII–10. VERMONT: Quechee, VII–4. MASSACHUSETTS: Monterey, VII–8; Natick, VII–30; Framingham, VIII–8; Attleboro, VI–27. CONNECTICUT: Cornwall, VI–29. NEW YORK: West Point, VII–1; Yaphank, VII–8; Artist's Brook, Essex Co., VI–11; Flatbush, VI–19 to VIII–11; Bear Mt., VII–6 to 28. PENNSYLVANIA: Wind Gap, VI–10 to VII–14; Hummelstown, VI–30 to VII–5; Philadelphia, VI–1; Easton, VII–17; Mt. Pocono, VI–27, VII–15. NEW JERSEY: Phillipsburg, VI–18; Millville, VI–23; Atsion, VI–27; Linwood, VII–17; Lakehurst, VII–3. MARYLAND: Beltsville, VI–14; Sparrows Point, VII–4 & 9; Odenton, VI–15, VII–14; Blythdale, VII–27; Dorchester Co., VII–10. VIRGINIA: Dismal Swamp,

V–27; Falls Church, VII–22 & 28; Roanoke, VI; Richmond, VII–2; Mountain Lake, Giles Co., VII–31. NORTH CAROLINA: Raleigh, V–8 to VIII–23; Balsam, VII–7; Black Mts., VI–20 to VII–14; Tryon, V–21, VI–1; Seaside, VI–8. SOUTH CAROLINA: Anderson, VI–5; Columbia, V–24; Clemson, V–25; Loris, V–26. TENNESSEE: Gatlinburg, VII–20; Crabtree, VII–8; Flat Top Mt., VI–20; Deer Lodge, VI; Unaka Mts., VI–23. GEORGIA: Waycross, VII–15; Valdosta, VII–20; Tybee Island, VI–21 to VII–5; Thomasville, V–18; Billy's Island, Okefenokee Swamp, VI, VII. ALABAMA: The Sinks, Bibb Co., V; Mobile. MISSISSIPPI: Lucedale, IV–22, VII–20; Gulfport, VIII–10. FLORIDA: Enterprise, V–16; Gainesville, IX–26; Lake Placid, III–19; Tampa, V–2; Naples, III–24. OHIO: Athens, VII–11; Fairfield Co., VII–15; Hocking Co., VI–20. MICHIGAN: Oakland Co., V–10; High Island, Charlevoix Co., VI–25 to VIII–12; Muskegon State Park, VII–19; Loon Lake, Lake Co., VIII–2; Cheboygan Co., VII–3. ILLINOIS: Oakwood, VI–2. WISCONSIN: Bayfield; Washburn Co., VII–27 to VIII–8. NORTH DAKOTA: Devil's Lake, VII–22. SOUTH DAKOTA: Elk Point, VII–1; Spearfish, VIII–1. ARKANSAS: No definite locality. OKLAHOMA: Broken Bow, VI–17. TEXAS: Karnack, V–22. COLORADO: Waldo Canyon, VII–31. NEW MEXICO: Las Vegas, VIII; Porvenir. ARIZONA: Flagstaff, VI–23; Williams, VII–18. CALIFORNIA: Viola, Shasta Co., V–28; Dunsmuir; Carrville, Trinity Co., VII–5. OREGON: Medford, VII–24; Butte Falls, VI–14; Mary's Peak, VII–12; McMinnville, VI–20. WASHINGTON: W. T. IDAHO: Coolin, Priest Lake, VII–22. BRITISH COLUMBIA: Midday Valley, VI–15; Creston, V–28 to VII–1; Allenby, VII–6; Brookmere, V–25. QUEBEC: Duparquet, VI–17 to VIII–14; Fort Coulonge, VI–10. ONTARIO: Toronto, VII–3; Sudbury; Fulton Township, VII–20.

This is our commonest and most widely distributed species. Its identity was established by Mr. J. Balfour-Browne, who dissected Newman's type at the British Museum, and forwarded very excellent drawings that matched beyond any possibility of doubt the genitalia of the present species.

The type of *Neoceletes crateracollis* Leng and Shoemaker, at the U. S. National Museum, is obviously a deformed specimen of *P. lictor*, having identical genitalia. Van Dyke's type of *Plateros*

californicus, at the California Academy of Sciences, likewise has the same conclusive genitalic structure of *lictor*.

Mr. W. J. Brown, of the Canadian Department of Agriculture at Ottawa, kindly forwarded for study a male paratype of his *Plateros columbiensis*, which proved to be an example of *P. lictor*. The specimen was returned to Mr. Brown, who compared its genitalia with those of his holotype and several other paratypes, and reported that they are all identical.

(9) **Plateros batillifer** new species (Fig. 9.)

Black; pronotum fulvous with a longitudinal black spot in median three-fifths, more or less, broadly attaining base but usually not the apex. Form less elongate, length-width ratio about 2.5:1; elytral costae scarcely elevated; antennal vestiture suberect; eyes small, separated medially above by about one and three-fifths times their length. Differs from all other species in genitalic structure. Length 5-6.5 mm.

Holotype.—Male; Crailhope, Kentucky, VII–11–46, collected by Carl Cook; located in collection of California Academy of Sciences.

Paratypes.—6 males in collections of: Amer. Mus. Nat. Hist. (2); Calif. Acad. Sci. (2); Illinois Nat. Hist. Surv. (1); Univ. Calif. (1).

Distribution.—KENTUCKY: Crailhope, VII–11. NORTH CAROLINA: Raleigh, VII–15; Black Mts., VII–14; Valley of Black Mts., VIII–6; Crestmont, Haywood Co., VII–19. MICHIGAN: Huron Mts., Marquette Co., VII–12; Harbert Dunes, Berrien Co., VII–24. ILLINOIS: Spring Bay, VII–4; S. Illinois.

(10) **Plateros coccinicollis** Fall (Fig. 10.)

1910. *Plateros coccinicollis* Fall, Trans. Amer. Ent. Soc., XXXVI, p. 139.

MALE.—Black; pronotum pale rosy red with usually a subquadrate black spot in median third, more or less, narrowly attaining base in the central channel, the apical and lateral borders broadly rufous. Form narrowly elongate, subparallel, length-width ratio about 3.5:1; pronotum semi-elliptic, anterior angles obliterated, sides and apex evenly and rather steeply reflexed all around, surface finely punctate, coarse submarginal punctures inconspicuous; elytral sculpture shallow, finer than usual, pubescence very short, discal costae obsolete; antennae slender, vestiture suberect; eyes small, separated medially above by about one and three-fourths times their length. Length 7-9 mm.

FEMALE.—Pronotal spot tending to divide both longitudinally and transversely, sometimes entirely absent; eyes smaller, separated medially above

by about two and two fifths times their length; antennae shorter and stouter, the vestiture not erect.

Distribution.—Colorado: Boulder Canyon, 7340 ft., IX–22. New Mexico: Tusas, VII–29; Rio Arriba Co., VIII–31; Jemez Mts., III–20; Beulah, VIII–6 & 17. Arizona: Santa Catalina Mts., VII–20 to VIII–13; Chiricahua Mts., 8600 ft., VII–16; Williams, VIII–9.

Fall's type, in the Museum of Comparative Zoology, is a female with the pronotum lacking a central black spot. The second specimen in the Fall collection, also a female, has the spot divided longitudinally, black near the base and becoming nubilous anteriorly. The species is easily recognizable by its distinctive habitus so that association of the sexes may be made with confidence.

(11) **Plateros roseimargo** Fall (Fig. 11.)

1910. *Plateros roseimargo* Fall, Trans. Amer. Ent. Soc., xxxvi, p. 139.

Black; pronotum pale rosy red, varying to fulvous, with a longitudinal or subquadrate black spot in median three-fifths, more or less, broadly attaining base but not apex. Form elongate, length-width ratio about 3.0:1; pronotum more transverse than in *coccinicollis*, subpentagonal, the anterior angles usually feebly indicated; elytral sculpture usually shallow and finer than normal, pubescence very short, discal costae nearly or quite obsolete; antennal vestiture inclined, more erect internally and throughout on distal joints; eyes small, separated medially above by about one and three-fifths times their length. Length 5.5-7.5 mm.

Distribution.—Arizona: Santa Rita Mts., VII–13; same, 5–8000 ft., VII; Chiricahua Mts., Rustler Park, 8–9000 ft., VII–26; same, 8200 ft., VIII–17; Chiricahua Mts., Fly's Peak, 9500 ft., VII–9; Barefoot Park, Cochise Co., 8500 ft., VIII–6; Huachuca Mts., VII–15 & 20; Huachuca Mts., Carr Canyon, VII–7; same, 7500 ft., VIII–6; Palmerlee, VII–13.

The identity of this species was confirmed by examination of the genitalia of the type in the Fall collection at the Museum of Comparative Zoology. It somewhat resembles *P. coccinicollis,* being intermediate in that respect between *coccinicollis* and the normal habitus of the species of the eastern states.

(12) **Plateros sollicitus** (Leconte) (Fig. 12.)

1847. *Eros sollicitus* Leconte, Jour. Acad. Nat. Sci. Phila., 2nd ser., I, p. 83.
?1930. *Plateros timidus* ab. *humeralis* Hatch, Publ. Okla. Biol. Surv., II, p. 23.

Black; pronotum fulvous with a longitudinal black spot in median three-fifths, more or less, usually attaining base but not apex; humeral callus of elytra, and usually also the marginal bead at base, fulvous; legs usually fulvous basally, the anterior pair most extensively, varying to entirely black; mesosternum sometimes fulvous. Form elongate, length-width ratio about 2.7:1; elytral costae usually feebly elevated; antennae slender, vestiture erect; eyes large, separated medially above by a little less than their length. Length 6.5-8.75 mm.

Distribution.—NEW YORK: Albany, VII–8. PENNSYLVANIA: Wind Gap, VII–25. NEW JERSEY: Da Costa, VI–29; Dumont, VI; Cape May, VII–13; Gloucester Co., VIII–10; Anglesea, VI–10. MARYLAND: Sparrows Points, VII–9. VIRGINIA: Vienna, VI–29. KENTUCKY: Crailhope, VI–23. NORTH CAROLINA: Linnville, 3500 ft., VII–16; Black Mts., VI–20 & 24; Swannanoa, VII–19. ALABAMA: The Sinks, Bibb Co., V. GEORGIA: Yonah Mt., VI–23. ILLINOIS: Pittsfield, VII–6, VIII–20. ARKANSAS: Washington Co., VII–5 & 8; same, Mt. Sequoyah, VI–22. OKLAHOMA: Hitchite, VI–26.

The identity of this species was established by examination of the genitalia of the type, located in the Leconte collection at the Museum of Comparative Zoology.

The female holotype of *Plateros timidus* ab. *humeralis* Hatch, generously loaned for study by Dr. Hatch, apparently belongs here, although that is not at all certain. The paratype of *humeralis*, also a female, is probably not conspecific.

(13) **Plateros floralis** (Melsheimer) (Fig. 13.)

1845. *Dictyopterus floralis* Melsheimer, Proc. Acad. Nat. Sci. Phila., II, p. 302.

Black; pronotum fulvous with a longitudinal black spot in median half, more or less, usually broadly attaining base but not apex. In some specimens from the southern part of its range the legs may be fulvous basally, and the pronotal spot much reduced, not attaining base. Form less elongate, length-width ratio about 2.5:1; elytral costae scarcely elevated; antennal vestiture inclined; eyes large, separated medially above by about one and one-tenth times their length. Length 5-7.25 mm.

Distribution.—NEW YORK: Cyps Hill, Long Island, VI–21; Parkville; Flatbush, VII–28. CONNECTICUT: Cornwall, VII–7. PENNSYLVANIA: Easton, VII–12; Wind Gap, VII–11. NEW JERSEY: Trenton, VIII–6; Chatsworth, VI–29, VII–6; Freehold,

VII–19; Da Costa, VI–29. MARYLAND: Sparrows Point, VII–3 to 9; Odenton, VI–15; Baltimore, VII–10; Chesapeake Beach, VII–12. VIRGINIA: E. Falls Church, VII–13. NORTH CAROLINA: Black Mts., VI–15, VII–3; Southern Pines, V–23 & 30; Raleigh, VI–26. GEORGIA: Spring Creek, V–21; Milner, V–29; Roberta, V–1. MISSISSIPPI: Lucedale, IV–13 to 28. FLORIDA: Enterprise, IV–18 & 29; Sanford, III–10. OHIO: Ft. Ancient, Warren Co., VI–21. MICHIGAN: Cheboygan, VII–28; Ogemah Reserve, VII–17; Onota Twp., Alger Co., VIII–2; Schoolcraft Co., VII–16; Midland Co., VII–17. ILLINOIS: Elizabethtown, V–22. ARKANSAS: S. W. Ark. TEXAS: Karnack, V–22. ONTARIO: Toronto, VII–3; Prince Edw. Co., VII–18.

The identity of this species was established by examination of the genitalia of a designated lectotype, without locality data, in the Melsheimer collection at the Museum of Comparative Zoology.

(14) Plateros subtortus new species (Fig. 14.)

Black; pronotum fulvous with a longitudinal black spot in median three-fifths, more or less, nearly attaining base, the sides and apex broadly fulvous; elytra entirely black; legs, excluding the coxae, fulvous basally, the anterior pair most extensively. Form moderately elongate, length-width ratio about 2.6:1; elytral costae scarcely elevated; antennal vestiture suberect; eyes very large, separated medially above by about six-sevenths of their length. Length 5-7 mm.

Holotype.—Male; Millville, New Jersey, VI–26-25, collected by F. C. Fletcher; located in collection of California Academy of Sciences.

Paratypes.—6 males in collections of: Acad. Nat. Sci. Phila. (1); Amer. Mus. Nat. Hist. (1); Calif. Acad. Sci. (1); Cornell Univ. (1); North Carolina Dept. Agric. (1); U. S. Nat. Mus. (1).

Distribution.—NEW JERSEY: Lakehurst, VII–5; Millville, VI–26. MARYLAND: Sparrows Point, VII–9. NORTH CAROLINA: Southern Pines, V–30; Laurel Hill, VI–1. GEORGIA: No definite locality. MISSISSIPPI: Lucedale, V–7.

In genitalic structure *subtortus* agrees with *floralis* in the half twist affecting the distal part of the median lobe, but differs greatly from that species in lacking completely any sub-basal prominence, and in the much less extensive sclerotization of the ventral surface of the basal piece.

(15) **Plateros flavoscutellatus** Blatchley (Fig. 15.)

1914. *Plateros flavoscutellatus* Blatchley, Can. Ent., XLVI, p. 89.

Blatchley described this species from a color phase restricted to Florida. The great majority of specimens, distributed over a large territory, are colored as follows: black; pronotum fulvous with a longitudinal black spot in median three-fifths, more or less, broadly attaining base but usually not quite reaching apex. The Florida color phase is easily recognizable without recourse to the genitalia. It is black, pronotum fulvous with a longitudinally divided central black spot not attaining base or apex; scutellum usually fulvous; humeral costa of elytra at base, and sutural and lateral marginal beads except towards apex, fulvous; first antennal joint fulvous beneath; legs more or less fulvous basally, the anterior pair most extensively. Form less elongate, length-width ratio about 2.4:1; elytral costae scarcely elevated; antennal vestiture not erect; eyes small, separated medially above by about one and one-half times their length. Length 3.5-7.25 mm.

Distribution.—MAINE: Cornish, VI–28; Augusta, VII–2; Monmouth, VII–12; Paris, VII–13 & 20; Casco, VIII–2. NEW HAMPSHIRE: Squam Lake, VII–11; Hampton, VI–24 to IX–6; Center Harbor, VII–10. MASSACHUSETTS: Natick, VII–15, VIII–8; Chicopee, VII–1; Monterey, VII–8; Westport, VII–24; Dartmouth, VII–1. CONNECTICUT: Hamden, VI–18; Cornwall, VII–8; Litchfield, VII–25 to VIII–21; New Britain. NEW YORK: Bear Mt., VII–20; Riverhead, VI–20; Whitehall, VI–26; Armonk, VII–21; Thorn Mt., VII–1. PENNSYLVANIA: Tannersville, VII–6; Mt. Pocono, VI–27; Hummelstown, VII–4; Reading, VII–21; Milford, VII–8. NEW JERSEY: Millville, VI–22; Lakehurst, VI–3, VII; Atsion, VI–27; Cape May, VII–13; Westville, VIII–14. MARYLAND: Odenton, VI–16, VII–12; Glen Echo, VI–23; Dorchester Co., near Lloyds, VII–10; Beltsville, VI–14; Baltimore, VII–16. DISTRICT OF COLUMBIA: Washington, VI–23. VIRGINIA: Norfolk, VI; Roanoke, VI–28; Fredericksburg. WEST VIRGINIA: White Sulphur, VII. TENNESSEE: Gatlinburg, VII–8 & 21; Erwin, VI; Cumberland Co., Grassy Cove, VII–10; Great Smoky Mt. Nat. Park, VI–14. NORTH CAROLINA: Raleigh, V–28, VII–15; Graybeard Mt., VI–19; Black Mts., VII–14; Beaufort, VI–4; Aberdeen, V–25. SOUTH CAROLINA: Rocky Bottom, VI–16. GEORGIA: Tybee Island, VII–2; Cartersville, V–25; Lakemont, VI–11; Barnsville, V–15; Thomasville, V–16. ALABAMA: Bryant, Sand Mt., Jackson Co., VI–23. MISSISSIPPI: Lucedale,

IV–22. Florida: Palm Beach, III–26; Key Largo, V–13; Enterprise, V–14; Alachua Co., IV–13. Ohio: Cincinnati, VI–10; Hocking Co., VI–30 to VII–25; Athens, VI–12 to VII–22; Green Co., VII–8; Clifton, VI–16. Indiana: Clark County State Forest, VI–15, VII–10. Michigan: Pentwater, VII–17; Ingham, VII–8; Muskegon State Park, VII–19. Illinois: Fairfield, VI–12; Bishop, VI–22; Grafton, VI–26; Oregon, VII–8; Monticello, VII–9. Minnesota: No definite locality. South Dakota: Whitewood, VII–8; Ft. Thompson, VI–28. Missouri: Ranken, VI–29; New Hartford, VI–23; Willard, Greene Co., VI–5. Arkansas: Hope, VI–2. Kansas: Riley Co., VI. Oklahoma: Ada, VII–16. Texas: Benchley, IV–30; Marshall, VI–6; Karnack, V–22. Nova Scotia: Portaupique, VII–26.

Distribution (Typical color phase, as described by Blatchley): Florida: Gainesville, IV–13; Lake Placid, IV–26; Enterprise, IV–15; Lakeland, III–28; Eustis, IV–5; F. Capron, III–30; Dunedin, III–27 to IV–7; Blanton, IV–9; Sanford, IV–3; Ormond, IV–11; Marion County.

This species is quite abundant, being second only to *P. lictor* in that respect. It seems likely that one or more of the older names in the list of unknown species belong here. In the event that this can be demonstrated, the Florida color phase described by Blatchley should be reduced to subspecific, or perhaps a lower, rank. A new name might at this time be proposed for the more widely distributed and normally colored phase, but such a name would necessarily be subordinate to *flavoscutellatus*, contrary to the overwhelming evidence available.

(16) **Plateros peregrinus** new species (Fig. 16.)

Black; pronotum fulvous with a longitudinal black spot in median three-fifths, more or less, broadly attaining base and usually the apex; legs and usually the elytra entirely black, the humeral callus rarely fulvous (Florida). Form moderately elongate, length-width ratio about 2.6:1; elytral costae scarcely elevated; antennal vestiture suberect; eyes moderate, separated medially above by about one and one-fourth times their length. Length 5.25-8 mm.

Holotype.—Male; Duparquet, Quebec, VII–28–34, collected by G. Stace Smith; located in collection of California Academy of Sciences.

Paratypes.—33 males in collections of: Acad. Nat. Sci. Phila. (1); Calif. Acad. Sci. (20); Cornell Univ. (2); Illinois Nat. Hist. Survey (1); Ohio State Univ. (1); U. S. Nat. Mus. (5); Owen Bryant (1); C. A. Frost (1); F. H. Parker (1).

Distribution.—MAINE: Mt. Katahdin, VI; Millinocket, VI–25. NEW JERSEY: Da Costa, VI–29. VIRGINIA: Falls Church, IV–25. GEORGIA: Roberta, V–16. FLORIDA: Lake Placid, IV–1. INDIANA: Miller, VII–20; Clark County State Forest, VII–3. MICHIGAN: Horn Mt. Club, VI–28; Huron Co., VII–3; Montmorency Co., VII–14; Cheboygan Co., VII–12. MINNESOTA: Duluth. ARKANSAS: Hope, VI–6. COLORADO: Junction Creek, VII–14. NEW MEXICO: Porvenir; Las Vegas, VIII. ARIZONA: Williams, VII–2 & 18; White Mts., VII–8. IDAHO: Coolin, Priest Lake, VII–18; Coeur d'Alene. OREGON: Mt. Hood, VII–26; Sparta, Baker Co., VII–3. BRITISH COLUMBIA: Creston, VII–16; Red Pass, VIII–7; Barriere, VI–15; Trinity Valley, VI–26; Prince George, VII–19; Terrace. QUEBEC: Duparquet, VII–4 to 28. ONTARIO: E. Ont.

In this and in the preceding species only, the small membranous area, possibly the terminus of the ejaculatory duct, is located near the middle on the right side of the median lobe of the aedeagus. Differences in genitalic structure, especially as seen from a lateral viewpoint, readily separate *peregrinus* from *flavoscutellatus*.

(17) **Plateros ocularis** new species (Fig. 17.)

Black; pronotum fulvous with a longitudinal black spot in median half or more, attaining the base but usually not the apex; legs usually more or less fulvous basally, the anterior pair most extensively. Form less elongate, length-width ratio about 2.5:1; elytral pubescence distinctly longer than normal, not dense, discal costae scarcely elevated; antennal vestiture suberect; eyes very large, separated medially above by about four-fifths of their length. Length 4.75-6.25 mm.

Holotype.—Male; Harrison County, Texas, V–18–48; collected by D. J. and J. N. Knull; located in Ohio State University collection.

Paratypes.—5 males in collections of: Calif. Acad. Sci. (1); Oregon State Univ. (1); C. A. Frost (3).

Distribution.—LOUISIANA: Tallulah, VI–13 to 30. TEXAS: Harrison County, V–18.

This species and the two following constitute a small group characterized by a peculiar type of genitalic structure. The median lobe in *ocularis* rather closely resembles that of *volatus*, but differs in being somewhat sinuate in lateral aspect, while in *volatus* the median lobe is perfectly straight. The very large eyes and longer elytral pubescence furthermore distinguish *ocularis* from both *volatus* and *avians*.

(18) **Plateros volatus** new species (Fig. 18.)

Black; pronotum fulvous with a longitudinal black spot in median two-thirds, more or less, broadly attaining base and apex; legs black, the anterior femora rarely fulvous basally. Form elongate, length-width ratio about 2.7:1; elytral costae sometimes feebly elevated, at least in basal half; antennal vestiture suberect; eyes moderate, separated medially above by about one and one-third times their length. Length 6-8 mm.

Holotype.—Male; Natick, Massachusetts, VI–19–46, collected by C. A. Frost; located in collection of California Academy of Sciences.

Paratypes.—14 males in collections of: Amer. Mus. Nat. Hist. (2); Calif. Acad. Sci. (3); Cornell Univ. (4); Illinois Nat. Hist. Survey (1); San Diego Nat. Hist. Mus. (1); C. A. Frost (2); Ohio State Mus. (1).

Distribution.—New York: Shelter Island, IX–4; Big Moose, VI; Old Forge, VIII–3. Massachusetts: Sherborn, VI–18 to VII–5; Natick, VI–19. Pennsylvania: Pricetown; Tannersville, VI–30, VII–6. New Jersey: Browns Mills, VI–11. Ohio: Buckeye Lake, Licking Co., VI–16. Tennessee: Unaka Sp. VI. Florida: No definite locality. Michigan: Whitefish Point, VII–13.

This species could be confused only with *ocularis*, having somewhat similar genitalia. The principal distinguishing characters are stated in the remarks under that species.

(19) **Plateros avians** new species (Fig. 19.)

Black; pronotum fulvous with a subquadrate or longitudinal black spot in median half or more, usually attaining base but not apex; elytra usually with humeral callus fulvous; legs rarely all black, usually fulvous basally, the anterior pair most extensively. Form elongate, length-width ratio about 2.9:1; elytral costae usually freebly elevated, at least in basal half; antennal vestiture suberect; eyes small, separated medially above by about one and two-thirds times their length. Length 6-8.5 mm.

Holotype.—Male; Wind Gap, Pennsylvania, VII–11–46, collected by J. W. Green; located in collection of California Academy of Sciences.

Paratypes.—25 males in collections of: Acad. Nat. Sci. Phila. (1); Amer. Mus. Nat. Hist. (3); Calif. Acad. Sci. (6); Cornell Univ. (5); Illinois Nat. Hist. Survey (2); North Carolina Dept. Agric. (1); Ohio State Univ. (2); U. S. Nat. Mus. (3); C. A. Frost (1); Ohio Univ. (1).

Distribution.—New York: Cyps Hill, VII–15 & 16; Bear Mt., VII–23. Pennsylvania: Lehigh Gap, VII–14 & 19; Wind Gap, VII–11. New Jersey: Millville, VI–23; Sand Hills, VII–21; Gloucester Co., VI–10; Malaga, VIII–4; Freehold, VII–19. Maryland: Baltimore, VII–12; Odenton, VI–14, VII–4. North Carolina: Raleigh, VII–15; Black Mts., VII; Southern Pines, V–22; Highlands, VII–5. South Carolina: Rocky Bottom, VI–20. Florida: Marianna, Jackson Co., VI–4. Ohio: Hocking Co., VII–20. Illinois: Alta Pass, VIII–13.

The characteristic genitalia, although similar in type to the two preceding species, easily distinguish this species from all others in the Nearctic fauna.

(20) **Plateros capillaris** new species (Fig. 20.)

Black; pronotum fulvous with a central subquadrate black spot leaving wide lateral and apical borders, and the narrow reflexed basal margin, fulvous, the spot sometimes partially divided longitudinally; humeri of elytra fulvous, the pale color extending from the humeral costa to the lateral margin; legs, excluding the coxae, fulvous basally, the anterior pair most extensively. Form elongate, length-width ratio about 2.9:1; elytral costae feebly elevated, at least in basal half; antennae slender, the vestiture suberect; eyes large, separated medially above by about their length. Differs from all other species in genitalic structure; median lobe unusually long and very slender. Length 7-9 mm.

Holotype.—Male; Perry, Georgia, V–12–39, collected by P. W. Fattig; located in collection of California Academy of Sciences.

Paratypes.—4 males in collections of: Amer. Mus. Nat. Hist. (2); Cornell Univ. (1); Illinois Nat. Hist. Survey (1).

Distribution.—Georgia: Perry, V–12. Florida: Coronado Beach, V–15; Kissimee; Biscayne Bay; Haulover, X–4.

(21) **Plateros timidus** (Leconte) (Fig. 21.)

1847. *Eros timidus* Leconte, Jour. Acad. Nat. Sci. Phila., 2nd ser., I, p. 80.

Black; pronotum fulvous with a longitudinal black spot in median half, more or less, usually attaining base and sometimes the apex; in one example (Florida) the pronotum is black with only the reflexed edges obscurely fulvous; humeral callus of elytra usually fulvous; legs not, or only slightly, tinged with fulvous basally. Form elongate, length-width ratio about 2.8:1; elytral costae scarcely elevated; antennae slender, the vestiture inclined, suberect internally; eyes rather large, separated medially above by slightly more than their length. Length 6-7.5 mm.

Distribution.—PENNSYLVANIA: Wind Gap, VII–14; Glenolden, VI–20; Hummelstown, VII–4. NEW JERSEY: Englewood, VII–18; Emerson, VI–10; Cape May, VII–13; Alpine, VI–25. MARYLAND: Odenton, VI–23; Baltimore, VII–12; Sparrows Point, VII–8. - KENTUCKY: No definite locality. TENNESSEE: Allardt, Fentress Co., VII–21, VIII–15. NORTH CAROLINA: Black Mts., VI–22, VII–14; Cranberry, VI–9. GEORGIA: Thomasville, IV–23; Everett. MISSISSIPPI: Lucedale, VI–7. OHIO: Delaware Co., VII–1. ILLINOIS: Alma, VI–6. MISSOURI: St. Louis, V. ARKANSAS: Marion Co., VII. TEXAS: Karnack, V–22.

The identity of this species was established by examination of the genitalia of the type, located in the Leconte collection at the Museum of Comparative Zoology.

(22) **Plateros modestus** (Say) (Fig. 22.)

1835. *Lycus modestus* Say, Boston Jour. Nat. Hist., I, p. 153.

Black; pronotum fulvous with a longitudinal black spot in median two-thirds, more or less, broadly attaining base and nearly or quite reaching apex. Form rather broad, length-width ratio about 2.3:1; elytral costae very distinctly elevated; antennal vestiture inclined, erect on inner face of median joints; eyes small, separated medially above by about one and one-half times their length. Length 7.25-10.5 mm.

Neotype.—Male; Sparrows Point, Maryland, VII–4–32, collected by J. W. Green; located in collection of California Academy of Sciences.

Distribution.—NEW YORK: Ithaca, VII–12. PENNSYLVANIA: Linglestown, VI–28; Swarthmore, VI–14; Easton, VI–6, VII–19; Wind Gap, VI–14. NEW JERSEY: Boonton, VI–14; Malaga, VII–20; Anglesea, VII–1; Da Costa, VI–29. MARYLAND: Sparrows

Point, VII–3 to 9. DISTRICT OF COLUMBIA: D. C., VI–4. VIRGINIA: Alex. Co., VI–15; Glencaryln, VI–11; Falls Church, VII–10; Rosslyn, VII–4; Gt. Falls, VI–16. KENTUCKY: No definite locality. NORTH CAROLINA: Raleigh, V–18 to VI–13; Black Mts., VI–12. GEORGIA: No definite locality. ALABAMA: Mobile, V–12; Barton, Colbert Co., VI–9; Grovehill, Clarke Co., V. OHIO: Athens, VI–11; Cincinnati, VI; Delaware Co., VI–21; Scioto Co., VI–10; Hocking Co., VI–14. INDIANA: Turkey Run, VI–20. ILLINOIS: Cobden, VI–10. KANSAS: Baldwin.

Say's type of *modestus* having been destroyed, the identity of his species cannot be known with certainty. The present species is the only one in our fauna that consistently agrees with the one significant point in Say's description of *modestus,* "Elytra with elevated longitudinal lines, and in the intervening spaces are numerous transverse elevated lines, and a small longitudinal one." In an occasional specimen the costae may be less prominent than usual, but they have never been noted to be completely obsolete. As a rule *modestus* may be easily recognized in both sexes by its large size, broad form, and costate elytra.

(23) **Plateros capitatus** new species (Fig. 23.)

Black; pronotum fulvous with a longitudinal black spot in median three-fifths, more or less, broadly attaining base but not apex; humeral callus of elytra fulvous, the marginal bead not paler; legs entirely black. Form elongate, length-width ratio about 2.7:1; elytral costae scarcely elevated; antennae slender, the vestiture suberect; eyes large, separated medially above by about their length. Differs from all other species in genitalic structure. Length 5.25-7 mm.

Holotype.—Male; Atlanta, Georgia, VI–17–41, collected by P. W. Fattig; located in collection of California Academy of Sciences.

Paratypes.—4 males in collections of: Calif. Acad. Sci. (2); Ohio State Univ. (1); Ohio Univ. (1).

Distribution.—OHIO: Athens, VI–16 & 24; VII–9; Hocking Co., VII–2. GEORGIA: Atlanta, VI–17.

(24) **Plateros subfurcatus** new species (Fig. 24.)

Black; pronotum fulvous with a longitudinal black spot in median three-fifths or more, broadly attaining base and nearly or quite the apex, often spreading at base to the posterior angles, or (Mts. of western North Carolina)

covering all the pronotum except the reflexed sides at the anterior angles; legs black, rarely slightly fulvous at base. Form less elongate, length width ratio about 2.5:1; elytral costae scarcely elevated; antennal vestiture inclined, suberect internally; eyes small, separated medially above by about one and two-thirds times their length. Differs from all other species in genitalic structure, the median lobe narrowly emarginate at tip. Length 4-7 mm.

Holotype.—Male; Tannersville, Pennsylvania, VII–18–47, collected by J. W. Green; located in collection of California Academy of Sciences.

Paratypes.—31 males in collections of: Acad. Nat. Sci. Phila. (1); Amer. Mus. Nat. Hist. (4); Calif. Acad. Sci. (10); Cornell Univ. (3); Illinois Nat. Hist. Survey (3); Ohio State Univ. (5); U. S. Nat. Mus. (2); R. R. Dreisbach (1); C. A. Frost (2).

Distribution.—Maine: Paris, VII–16. Massachusetts: Sherborn, VII–12. Connecticut: Cornwall, VII–17. New York: Riverhead, VI–20. Pennsylvania: Linglestown, X–4; Tannersville, VI–12 to 20; Wind Gap, VII–6; Hummelstown, VII–10. Maryland: Odenton, VI–2. Tennessee: Gatlinburg, VII–20. North Carolina: Southern Pines, V–20; Black Mts., VI–24, VII–2. Florida: Tarpon Springs, V–16; Dunedin, III–12 & 17. Ohio: Scioto Co., VI–20 & 17; Hocking Co., VII–20. Michigan: Harbert Dunes, Berrien Co., VII–24; Cheboygan Co., VII–2; Midland Co., VII–17. Illinois: No definite locality.

(25) **Plateros bispiculatus** new species (Fig. 25.)

Black; pronotum usually fulvous with a longitudinal black spot in median three-fifths, more or less, broadly attaining base but often not reaching the apex, rarely the pronotum is entirely black (Mts. of western North Carolina). Form moderately elongate, length-width ratio about 2.6:1; elytral costae scarcely elevated; antennal vestiture suberect; eyes small, separated medially above by about one and two-thirds times their length. Differs from all other species in genitalic structure. Length 4.75-7.5 mm.

Holotype.—Male; Wind Gap, Pennsylvania, VII–5–46, collected by J. W. Green; located in collection of California Academy of Sciences.

Paratypes.—79 males in collections of: Acad. Nat. Sci. Phila. (3); Agric. & Mech. College of Texas (1); Amer. Mus. Nat. Hist. (3); Calif. Acad. Sci. (32); Cornell Univ. (12); Illinois Nat. Hist. Survey (7); N. C. Dept. Agric. (1); Ohio State Mus. (1); Ohio State Univ. (11); Ohio Univ. (2); Univ. Calif. (1); U. S. Nat. Mus. (5).

Distribution.—Maine: Millinocket, VI–25. New York: Olcott, VII–17 to VIII–8; Saranac Inn, VII–8; Ithaca, VII–12; Boston, VIII–1. Pennsylvania: Delaware Water Gap; Lehigh Gap, VII–22; Wind Gap, VII–5 to VIII–1; Easton, VII–5 & 16; Allegheny Co., VII–2 & 16; Reading; Effort, VII–20; Tannersville, VII–31. New Jersey: Ramsey; Schooley's Mt., VI–29. Maryland: Plummers Island, VII–3; Sparrows Point, VII–3 to 9; Odenton, VI–23; Chain Bridge, IX–18. Virginia: Vienna, VI–1. North Carolina: Raleigh, VI–6; Cherokee, VI–28; Black Mts., VI–15; Cranberry, VI–9; Grandfather Mt., VII–21. Ohio: Delaware Co., VI–25 to VII–27; Scioto Co., VI–10; Franklin Co., VII–16; Pickaway Co., VII–7 to 31; Amherst, VII; Athens, VII–20. Indiana: Clark Co. State Forest, VI–13. Illinois: Galena, VII–10; Algonquin; Anna. Michigan: Marion Island, Grand Traverse Co., VII–25. Iowa: McGregor, VII–15. Ontario: Newago, VII–21; Toronto, VII–6; Muskoka, VII; Rideau Lk., VII–17.

(*26*) **Plateros perditus** new species (Fig. 26.)

Black; pronotum fulvous with a longitudinal black spot in median half, more or less, broadly attaining base and nearly or quite the apex. Form elongate, length-width ratio about 2.7:1; elytral costae not elevated; antennae slender, vestiture erect; eyes moderate, separated medially above by about one and one-third times their length. Differs from all other species in genitalic structure. Length 6-7 mm.

Holotype.—Male; Chatsworth, New Jersey, VI–29–46; collected by J. W. Green; located in collection of California Academy of Sciences.

Paratype.—Male; Atsion, New Jersey, VI–16–29, J. W. Green; same location.

(*27*) **Plateros transpictus** new species (Fig. 27.)

Black; pronotum fulvous with a longitudinal black spot in median three-fifths, more or less, broadly attaining base and nearly or quite the apex. Form less elongate, length-width ratio about 2.5:1; elytral costae scarcely elevated; antennal vestiture inclined, suberect internally; eyes moderately large, separated medially above by about one and one-sixth times their length. Length 4.25-5.5 mm.

Holotype.—Male; Sparrows Point, Maryland, VII–5–31, collected by J. W. Green; located in collection of California Academy of Sciences.

Paratypes.—15 males in collections of: Acad. Nat. Sci. Phila. (1); Calif. Acad. Sci. (12); Cornell Univ. (1); N. C. Dept. Agric. (1).

Distribution.—PENNSYLVANIA: Easton, VI–23. MARYLAND: Sparrows Point, VII 4 to 9. NORTH CAROLINA: Southern Pines, VI–10. MISSISSIPPI: Lucedale, IV–22.

In genitalic structure *transpictus* somewhat resembles the following species, *devians*. The subapical constriction of the median lobe in this species, as viewed dorso-ventrally, is lacking in *devians*.

(28) **Plateros devians** new species (Fig. 28.)

Black; pronotum fulvous with a longitudinal black spot in median half, more or less, nearly or quite attaining base but not the apex; legs fulvous basally, the anterior pair most extensively. Form elongate, length-width ratio about 2.7:1; elytral costae not elevated; antennae slender, the vestiture suberect; eyes large, separated medially above by about their length. Genitalia somewhat as in *transpictus*, in dorsal aspect lacking the subapical constriction of that species. Length 4.5-6.25 mm.

Holotype.—Male; Dunedin, Florida, III–1–30, collector unknown; located in collection of California Academy of Sciences.

Paratypes.—5 males in collections of: Cornell Univ. (1); Ohio State Univ. (2); U. S. Nat. Mus. (2).

Distribution.—MARYLAND: Dorchester Co., near Lloyds, VII–10. FLORIDA: Dunedin, III–1, IV–26. TEXAS: Karnack, V–22, VI–7.

(29) **Plateros centralis** new species (Fig. 29.)

Black; pronotum fulvous with a subquadrate central black spot not attaining base or apex and sometimes more or less longitudinally divided; scutellum black or fulvous; usually the marginal bead and sometimes the sutural bead of elytra fulvous basally, the humeral callus black; legs usually fulvous at base, the anterior pair most extensively; the underside of the prothorax, including the coxae, may be fulvous, sometimes also the mesosternum and middle coxae. Form elongate, length-width ratio about 3.0:1; pronotum less transverse, lateral margins subparallel or feebly diverging posteriorly; elytral costae scarcely elevated; antennae slender, vestiture erect; eyes moderate, separated medially above by about one and one-fourth times their length. Differs from all other species in genitalic structure. Length 5-8.5 mm.

Holotype.—Male; St. Simons Island, Georgia, VI–5–29, collected by P. W. Fattig; located in collection of California Academy of Sciences.

Paratypes.—70 males in collections of: Acad. Nat. Sci. Phila. (5); Amer. Mus. Nat. Hist. (5); Calif. Acad. Sci. (14); Cornell Univ. (8); Emory Univ. (1); Illinois Nat. Hist. Survey (7); N. C. Dept. Agric. (2); Ohio State Univ. (3); Ohio Univ. (3); Reading Public Mus. (7); U. S. Nat. Mus. (12); R. R. Dreisbach (1); C. A. Frost (2).

Distribution.—CONNECTICUT: Brookfield, VII–25. PENNSYLVANIA: Lehigh Gap, VII–20. NEW JERSEY: Lakehurst, VII–4; Atsion, VI–27 to VII–3; Chatsworth, VI–29; Millville, VI–22; Hewitt, VII–17. MARYLAND: Odenton, VI–16; Blythdale, VII–27; Sparrows Point, VII–5 to 9. OHIO: Hocking Co., VII–2 & 20. VIRGINIA: Clifton, VIII–21; Falls Church, VII–16 to 28. NORTH CAROLINA: Pinebluff, V–24; Nance, VI–16; Raleigh, VI–26, VII–15; Crestmont, Haywood Co., VII–23; Laurel Hill, VI–1. TENNESSEE: Headquarters Gt. Smoky Mt. Nat. Park, VI–14. GEORGIA: St. Simons Island, VI–5; Thomasville, IV–22. ALABAMA: Mobile, V–25. FLORIDA: Jacksonville; Marco, IV–19; Haulover, IV–10; Enterprise, IV–20, V–8, VI; F. Capron; Tarpon Springs, IV–18, V–16; Lake Worth; Alachua Co., V–8; Palm Beach, III–27, IV–6; Dunedin, IV–26. LOUISIANA: Spanish Fort, VIII–5.

This is the most abundant of several mutually similar species, any one of which might be *canaliculatus* Say, described from "Missouri." Most of the specimens of these species agree with Say's description of *canaliculatus,* in which he states that the thorax is "yellowish rufous, a large black subquadrate spot on the disk, anterior edge very prominently arcuated." The identity of *canaliculatus* can never be definitely established because Say's type has been destroyed. In the event that it should be deemed advisable to assign the name to a known species, it is suggested that the present one be selected for that purpose.

(30) **Plateros carinulatus** new species (Fig. 30.)

Black; pronotum fulvous with a central subquadrate black spot not attaining base or apex, sometimes partially divided longitudinally; scutellum black or fulvous; marginal bead of elytra fulvous basally, the humeral callus not paler; legs, including the coxae, extensively fulvous at base, excepting the posterior pair; mesosternum and underside of prothorax usually fulvous. Form elongate, length-width ratio about 3.0:1; pronotum less transverse, the lateral margins subparallel or slightly diverging posteriorly; elytral costae

not or feebly elevated; antennae long and slender, the vestiture erect; eyes moderate, separated medially above by one and one fourth times their length. Differs from all other species in genitalic structure; median lobe longitudinally carinate beneath toward base. Length 7.25-9.25 mm.

Holotype.—Male; Oriental, North Carolina, X–21–33, collected by D. L. Wray; located in collection of California Academy of Sciences.

Paratypes.—7 males in collections of: Acad. Nat. Sci. Phila. (1); Amer. Mus. Nat. Hist. (1); Cornell Univ. (1); Illinois Nat. Hist. Survey (1); Reading Public Mus. (2); U. S. Nat. Mus. (1).

Distribution.—North Carolina: Oriental, X–21. Florida: Dunedin, III–1; Enterprise, IV–24, V–4; Biscayne Bay; Miami, III–10; No definite locality.

(31) **Plateros borealis** new species (Fig. 31.)

Black; pronotum fulvous with a longitudinal black spot in median three-fifths, more or less, broadly attaining base but usually not the apex. Form less elongate, length-width ratio about 2.5:1; elytral costae feebly or scarcely elevated; antennae slender, the vestiture erect; eyes small, separated medially above by about one and one-half times their length. Differs from all other species in genitalic structure. Length 6-7.25 mm.

Holotype.—Male; Prince Edward County, Ontario, VII–15–34, collected by J. F. Brimley; located in collection of California Academy of Sciences.

Paratypes.—12 males in collections of: Calif. Acad. Sci. (2); Illinois Nat. Hist. Survey (3); Ohio State Univ. (1); R. R. Dreisbach (1); A. T. McClay (5).

Distribution.—Masschusetts: Woods Hole, VI–28. Michigan: Montmorency Co., VII–10 & 15. Illinois: N. Ill. Ohio: Ross Co., VII–4. Ontario: Addington Co., VII–16; Prince Edw. Co., VII–15 & 18.

(32) **Plateros australis** new species (Fig. 32.)

Black; pronotum fulvous with a central subquadrate black spot leaving wide lateral and apical borders, and the narrow reflexed basal margin, fulvous; marginal bead of elytra fulvous at base; legs fulvous basally, the anterior pair most extensively; metasternum fulvous postero-medially. Form elongate, length-width ratio about 2.7:1; elytral costae scarcely elevated; antennal pubescence suberect; eyes moderate, separated medially above by about one and one-third times their length. Differs from all other species in genitalic structure. Length 6-6.5 mm.

Holotype.—Male; Lucedale, Mississippi, IV–28–29, collected by H. Dietrich; located in Cornell University collection.

Paratype.—Male; Raleigh, North Carolina, VII–8–03, collected by F. Sherman, in collection of North Carolina Department of Agriculture.

Explanation of Figures

The letters a, b, and c signify, respectively, dorsal, lateral, and ventral aspects.

Fig. 1.—*Plateros sanguinicollis* Horn, male genitalia. Las Animas, Lower California, X-12-41, Ross and Bohart.

Fig. 2.—*Plateros arizonensis* new species, male genitalia. Santa Catalina Mts., Peppersauce Canyon, Pima Co., Arizona, VIII-13-40, J. J. DuBois.

Fig. 3.—*Plateros tumacacori* new species, male genitalia. Tumacacori Mts., Arizona, VIII-7-50, D. J. & J. N. Knull.

Fig. 4.—*Plateros knulli* new species, male genitalia. Sabino Canyon, Arizona, VII-30-50, D. J. & J. N. Knull.

Fig. 5.—*Plateros nigerrimus* Schaeffer, male genitalia. Patagonia, Arizona, VII-29-41, F. H. Parker.

Fig. 6.—*Plateros nigrior* new species, male genitalia. Williams, Arizona, VIII-2-49, D. J. & J. N. Knull.

Fig. 7.—*Plateros bidens* new species, male genitalia and abdominal sternites 8 and 9. Carrizo, Arizona, V-28-48, D. J. & J. N. Knull.

Fig. 8.—*Plateros lictor* (Newman), male genitalia. Wind Gap, Pennsylvania, VI-25-31, J. W. Green.

Fig. 9.—*Plateros batillifer* new species, male genitalia. Crailhope, Kentucky, VII-11-46, Carl Cook.

Fig. 10.—*Plateros coccinicollis* Fall, male genitalia. Santa Catalina Mts., Arizona, VII-20-42, H. A. Scullen.

Fig. 11.—*Plateros roseimargo* Fall, male genitalia. Chiricahua Mts., Rustler Park, Cochise County, Arizona, 8-9000 ft., VII-27-27, J. A. Kusche.

Fig. 12.—*Plateros sollicitus* (Leconte), male genitalia. Crailhope, Kentucky, VI-23-46, Carl Cook.

Fig. 13.—*Plateros floralis* (Melsheimer), male genitalia. Sparrows Point, Maryland, VII-8-32, J. W. Green.

Fig. 14.—*Plateros subtortus* new species, male genitalia. Millville, New Jersey, VI-26-25, F. C. Fletcher.

Fig. 15.—*Plateros flavoscutellatus* Blatchley, male genitalia. Paris, Maine, VII-13-46, C. A. Frost.

Fig. 16.—*Plateros peregrinus* new species, male genitalis. Lake Placid, Florida, IV-1-47, J. W. Green.

Fig. 17.—*Plateros ocularis* new species, male genitalia. Tallulah, Louisiana, VI-27-30, (no collector).

Fig. 18.—*Plateros volatus* new species, male genitalia. Natick, Massachusetts, VI-19-46, C. A. Frost.
Fig. 19.—*Plateros avians* new species, male genitalia. Wind Gap, Pennsylvania, VII-11-46, J. W. Green.
Fig. 20.—*Plateros capillaris* new species, male genitalia. Perry, Georgia, V-12-39, P. W. Fattig.
Fig. 21.—*Plateros timidus* (Leconte), male genitalia. Wind Gap, Pennsylvania, VII-14-31, J. W. Green.
Fig. 22.—*Plateros modestus* (Say), male genitalia. Sparrows Point, Maryland, VII-4-32, J. W. Green.
Fig. 23.—*Plateros capitatus* new species, male genitalia. Atlanta, Georgia, VI-17-41, P. W. Fattig.
Fig. 24.—*Plateros subfurcatus* new species, male genitalia. Tannersville, Pennsylvania, VII-18-47, J. W. Green.
Fig. 25.—*Plateros bispiculatus* new species, male genitalia. Wind Gap, Pennsylvania, VII-5-46, J. W. Green.
Fig. 26.—*Plateros perditus* new species, male genitalia. Chatsworth, New Jersey, VI-29-46, J. W. Green.
Fig. 27.—*Plateros transpictus* new species, male genitalia. Sparrows Point, Maryland, VII-5-31, J. W. Green.
Fig. 28.—*Plateros decians* new species, male genitalia. Dunedin, Florida, III-1-30, (no collector).
Fig. 29.—*Plateros centralis* new species, male genitalia. St. Simons Island, Georgia, VI-5-29, P. W. Fattig.
Fig. 30.—*Plateros carinulatus* new species, male genitalia. Oriental, North Carolina, X-21-33, D. L. Wray.
Fig. 31.—*Plateros borealis* new species, male genitalia. Montmorency County, Michigan, VII-10-23, T. H. Hubbell.
Fig. 32.—*Plateros australis* new species, male genitalia. Lucedale, Mississippi, IV-28-29, H. Dietrich.

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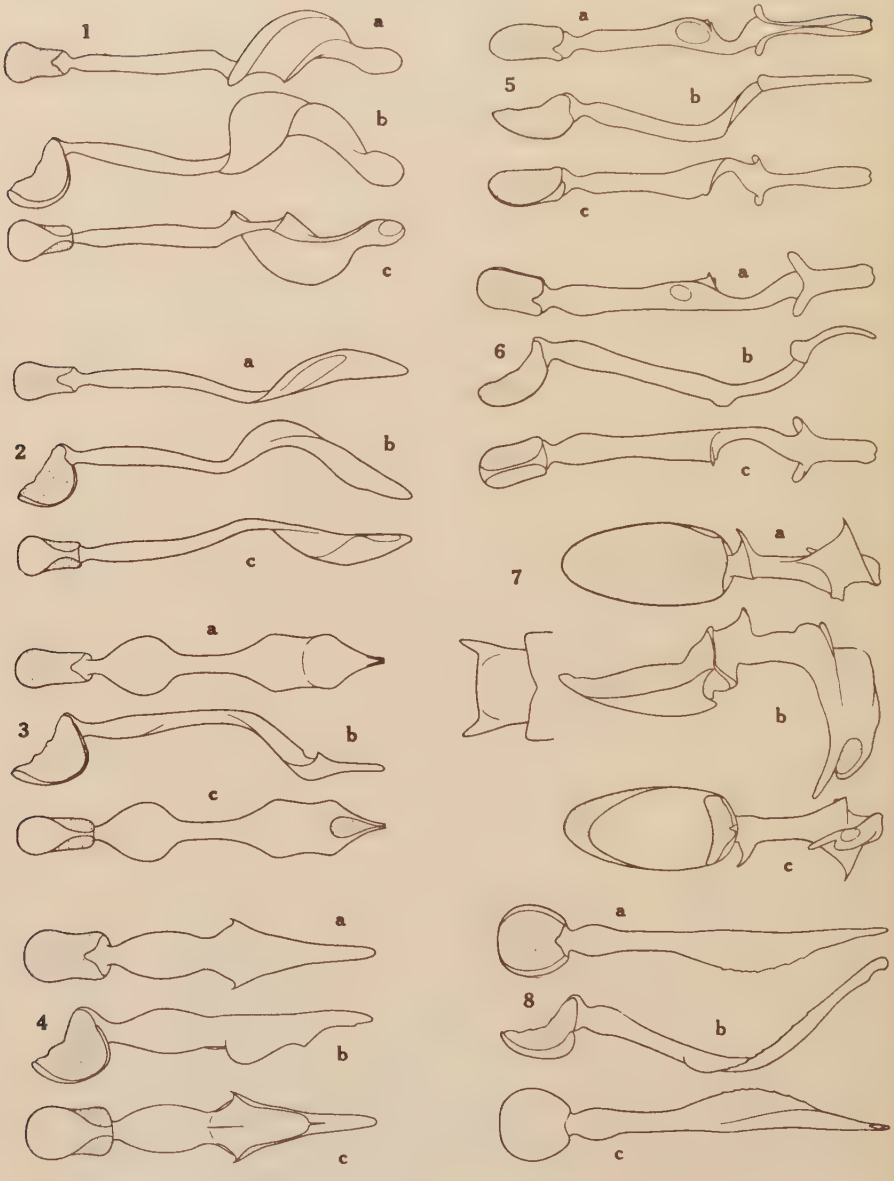
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b
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3
a
b
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8
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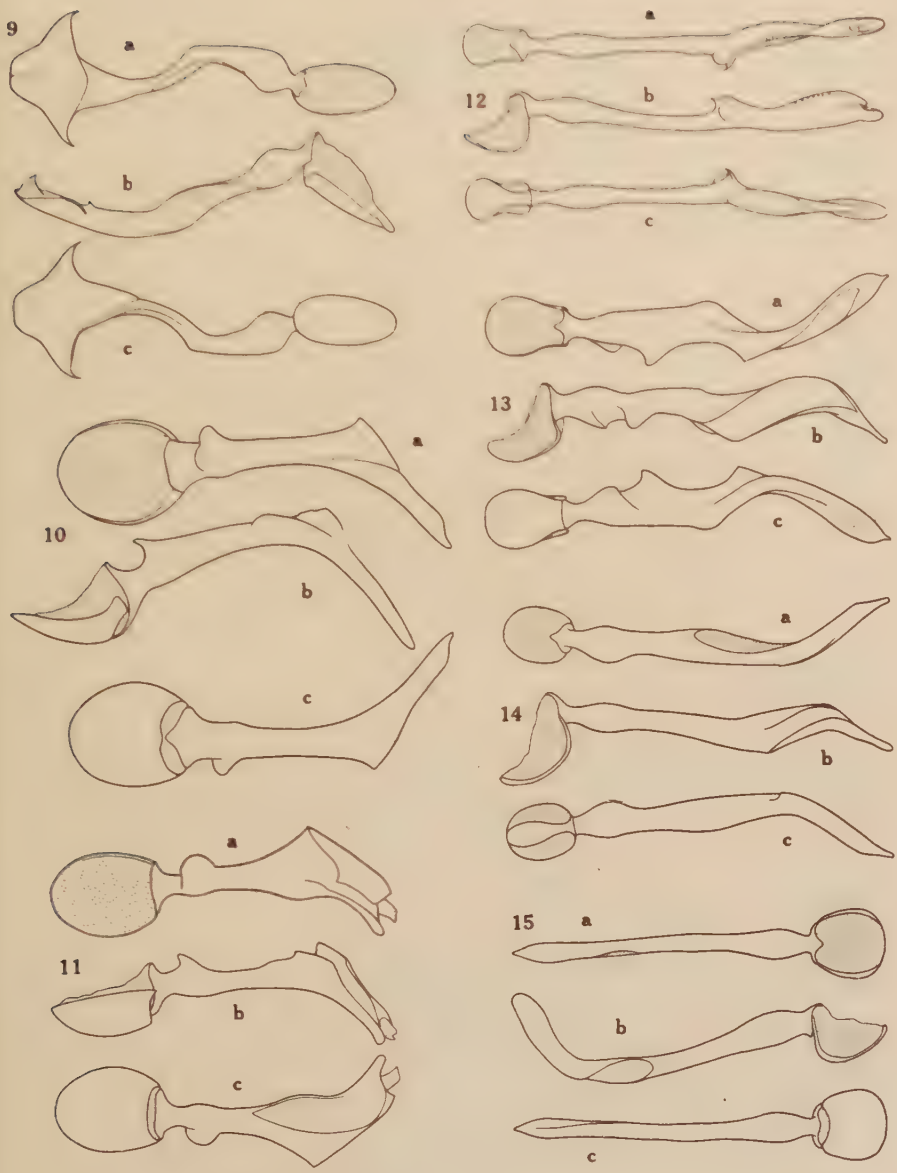
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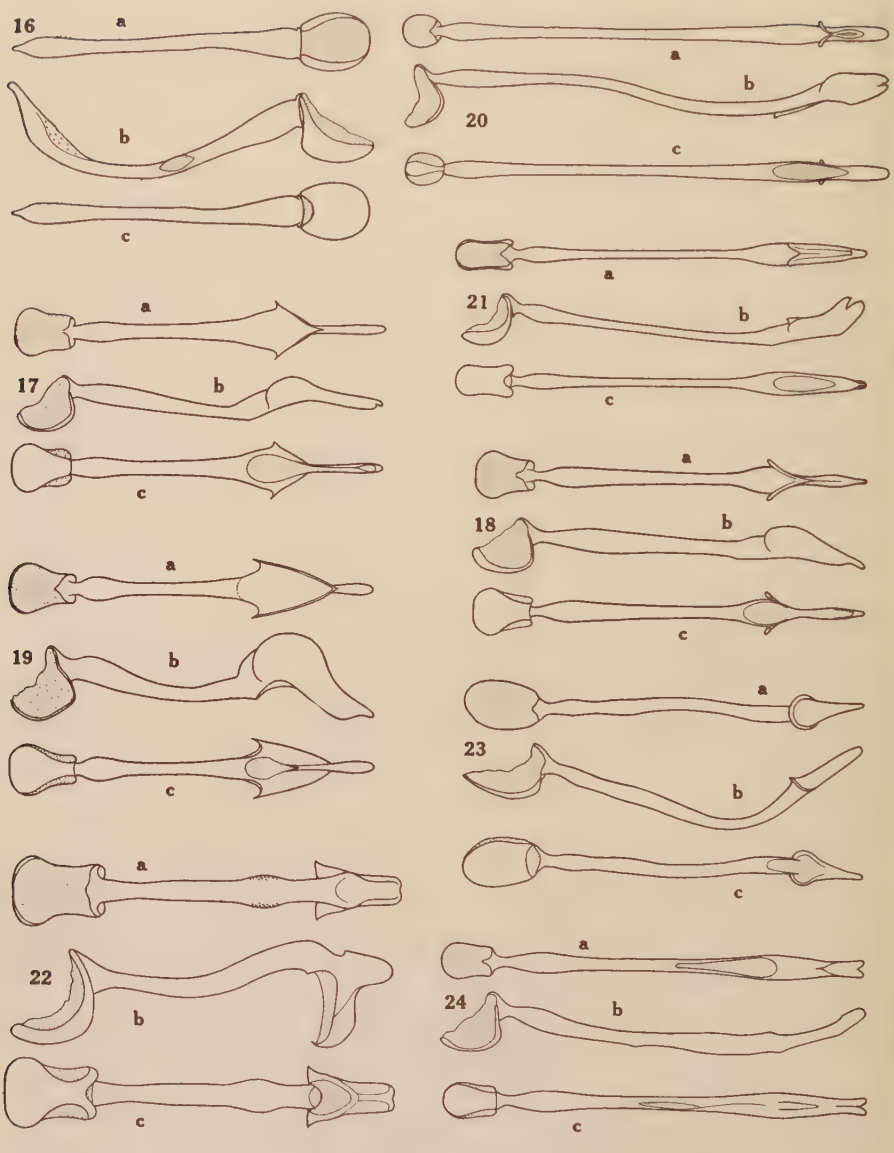
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c
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23
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24
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b
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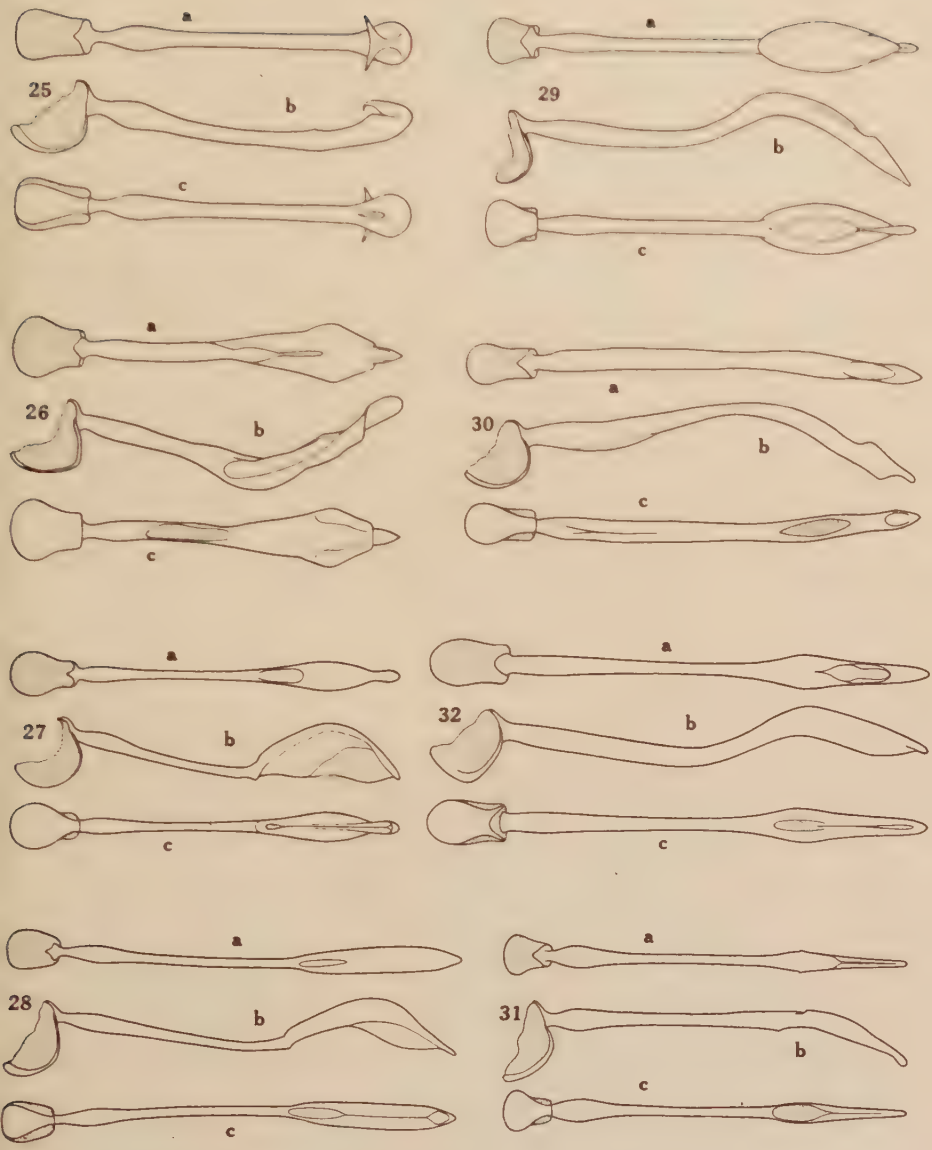
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b
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30
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b
c
27
a
b
c
32
a
b
c
28
a
b
c
31
a
b
c

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